

**A COMPARISON OF SYNTACTIC
REPRESENTATION AND PROCESSING
IN FIRST AND SECOND LANGUAGE PRODUCTION**

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Declaration

This thesis has been composed by myself, and the research presented herein is my own.
No portion of the work has been submitted for any other degree or professional qualification.

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ABSTRACT

This thesis compares and contrasts language production in L1 and L2 speakers, with a focus on how individual lexical items are built into syntactic structures. There has been much research in experimental psychology looking at the processes underlying syntactic processing in first language (L1) production. At the same time, much linguistic research on second language (L2) acquisition has compared the syntactic knowledge acquired by adult L2 learners with that of native speakers. However, there is surprisingly little discussion of how the two fields might come together, and a lack of experimental evidence comparing sentence production in L1 and L2 speakers.

In this thesis I present an empirical investigation into L1 and L2 syntax, using syntactic priming (Bock, 1986). I address whether syntactic representations are similar in L1 and L2 speakers, looking at structures that differ in terms of both functional (i.e., grammatical role assignment) and positional (i.e., linear word order) properties. I explore whether these representations are processed in a similar way across L1 and L2 groups, and what effect syntactic structures in the learners' L1 have on L2 processing. Finally, I look at the extent to which L1 and L2 syntactic information is associated with specific lexical items.

Experiments 1 and 2 showed priming of active vs. passive structures in both L1 and L2 (L1-English) speakers of Spanish at two different proficiency levels; L2 speakers showed stronger overall priming than L1 speakers, irrespective of proficiency. In all participants, priming was stronger when the verb was repeated across prime and target. Experiment 3 showed priming of English dative structures in L1 and L2 speakers and demonstrated that when structures are equally acceptable for native speakers L1 and L2 groups show similar priming magnitude, even when a structure is absent in the learners' L1. Experiments 4 and 5 dealt with the acquisition of preferences of intransitive verbs for particular word orders in L2 Spanish. L1 speakers preferred preverbal subjects with unergative verbs and postverbal subjects with unaccusatives, and were more susceptible to priming of postverbal word order with unaccusatives than unergatives. In contrast, L2 speakers were less sensitive to the unergative-unaccusative distinction and showed similar priming effects across the verb classes. Experiment 6 found equal priming of

unaccusative targets regardless of the class type of verb used in the prime, suggesting these preferences lie in processing the target not the prime.

Together, these results show broad similarities in the syntactic behaviour of L1 and L2 speakers, suggesting that L1 models of language production can be applied to L2 production, both at a functional and positional level. However, in line with linguistic findings on L2 optionality (e.g., Sorace, 2005), L2 speakers appear less sensitive to constraints on use of particular structures in the target language, tending to overuse inappropriate syntactic options. Finally, I offer novel evidence that lexical properties can influence word order production, which must be accounted for by models of production, for example by incorporating links between lexical items and word order representations.

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1 Introduction

1.1 Aim and focus of the study

The focus of this thesis is to look at how second language (L2) speakers produce sentences, when they have come to the new language as teenagers or adults? Learning a new language involves acquiring linguistic knowledge at many different levels, including vocabulary, pronunciation, and in some cases even new concepts. One of the most difficult aspects of learning a new language as an adult is taking on the L2 syntax (e.g., Hawkins, 2001; White, 2003). Each time a speaker prepares an utterance they must not only retrieve and select the appropriate words and sounds, but must also combine lexical units into larger phrases and sentences according to the structural rules available in the language. Often in a language the same idea can be expressed using more than one structural possibility, and a variety of factors influence which structure is chosen for output. L2 speakers must therefore also acquire when it is appropriate to use one structure versus another in the way native speakers do.

So how do L2 learners represent knowledge of constructions in the new language, and use this knowledge in language production? Is the architecture of the new linguistic system similar to that constructed in a first language (L1) speaker, who has been exposed to the syntax from childhood? A wealth of research in linguistics has investigated syntactic knowledge in L2 speakers (see Hawkins, 2001, and White, 2003, for reviews). However, this has largely employed off-line methods such as grammaticality judgments to determine L2 speakers' knowledge about the grammar of the new language. When discrepancies are found between L1 and L2 grammars, this is interpreted as reflecting L2 impairments either in representation (e.g. Beck, 1998; Eubank, 1996; Hawkins & Chan, 1997; Tsimpli & Roussou, 1990) or processing (e.g., Lardiere, 1998; Prévost and White, 2000; Robertson, 2000), but few studies investigate processing using lexico-sem methods, in order to justify this claim.

On the other hand, L1 production has been studied in great detail, leading to the

development of detailed models of monolingual production¹. These models are based largely on analysis of speech errors and experimental investigation, and as such reflect observed on-line behaviour (e.g., Bock & Levelt, 1994; Garrett, 1980, 1982, 1988; Levelt, 1989; Levelt, Roelofs and Meyer, 1999).

There is surprisingly little discussion of how the two fields could come together in order to develop psycholinguistic models of L2 production. The majority of experimental psychology investigations of L2 production focus on the lexical level (see Costa, 2005, for a review), without discussion of how lexical items are combined into syntactic structures. Those studies that do look at the sentence level focus on comprehension not production (see Clahsen & Felser, 2006, for a review); or how the two languages are kept separate or mixed, depending on the context (e.g., Green, 1998; Poulisse & Bongaerts, 1994). Given that the majority of the world speaks more than one language (Poulisse, 1997), a multilingual cognitive system should in fact be considered the default and a monolingual system the exception (de Bot, 1992). A shift is therefore needed in psycholinguistic research to take this into account.

In this thesis I argue that in order to fully understand how syntactic production occurs in L2 speakers there is a need for investigation of L2 sentence production. L1 and L2 speech can then be directly compared in order to address whether similar architectures and processing mechanisms underlie native and non-native systems. I will present a series of experimental investigations on the production of L2 syntactic structures, focusing in particular on what factors influence the choice of structure for a particular utterance.

So, are L2 speakers able to attain the same types of representations of syntactic knowledge and do they apply the same processing strategies to this knowledge? This thesis aims to highlight both similarities and differences between L1 and L2 syntactic production. Given that an L2 is acquired on top of a pre-existing, fully-developed linguistic system, there are strong reasons to believe that a common or similar architecture is involved the acquisition and use of two languages. This is supported by the

¹ By the term 'monolingual' in this context I refer to language production by a unilingual speaker in their native language (de Bot, 1992). However, monolingual is an ambiguous terms as it could also refer to a bilingual speaking in only one of their languages.

fact that many L2 speakers, with the right exposure, can reach very high levels of attainment, where speech is fluent and (to a certain extent) automatic.

However, there are also reasons to believe that there are key differences in the L1 and L2 systems. The picture emerging from research on very advanced or ‘near-native’ L2 grammars is that only certain areas of grammar present persistent problems to the L2 speaker (see Sorace, 2003, 2005, for a review). Most notably, L2 speakers exhibit residual optionality in the target language, treating two structures as equally appropriate for a particular context, where an L1 speaker would only accept one. L2 optionality is particularly marked at ‘interfaces’ between syntax and other cognitive systems, that is, where the choice of syntactic construction depends on factors like discourse-pragmatics or lexico-semantics. Thus, a particularly interesting area of L2 syntax to study is when a choice must be made between two structures, in the process of speaking.

The experiments I present are based on syntactic priming, the phenomenon that people have a tendency to repeat the syntactic form of a preceding, unrelated sentence. This is well established behaviour in L1 speakers across a range of structures and contexts, and is believed to tap into linguistic knowledge, with patterns of priming being informative about the nature of underlying syntactic representations (Branigan, Pickering, Liversedge, Stewart, & Urbach, 1995). It therefore offers a useful technique for comparing the factors affecting sentence-level production in L1 and L2 speakers.

1.2 Research questions

The focus of the current set of studies is to investigate to what extent the representations and mechanisms of syntactic production in L2 learners approximate those proposed for adult monolingual speech production in a variety of different contexts. This research offers a fresh perspective in two ways. Firstly, I attempt to see if established models of monolingual language sentence production can also account for sentence production in a second language speaker. Secondly, I contribute data on L2 sentence representation and processing to the L2 literature, which currently is based largely on off-line methods.

The research questions I aim to address concern the architecture of the L2 syntactic system and the representations it contains, as well as how these representations are processed. Is there evidence that L2 speakers possess abstract knowledge about

syntactic constructions in the target language, independent of specific lexical items? How are syntactic representations associated with lexical items and how does this influence processing? How might syntactic knowledge from the learner's L1 affect processing in their L2? How does processing of syntactic structures differ in L1 and L2 speakers?

I explore these issues looking at a range of sentence constructions. L1 production models often posit different stages of processing syntactic functions, hierarchical phrasal specifications and linear word order of a phrase. I therefore compare production of structures which differ in terms of both function relation and position of constituents, across L1 and L2 speakers.

A final issue of investigation concerns whether L2 speakers have an understanding of the appropriateness of different structures in the L2. Particular structures may be grammatical but rarely used by native speakers, or are only felicitous in a particular context. As mentioned above, L2 speakers are known to have trouble with these aspects of the target language, and I discuss this further in the course of the thesis.

Overall, the aim of the research was to compare L1 and L2 sentence production in a variety of contexts. I anticipated broad similarities in the representations and processing in L1 and L2 linguistic systems, but predicted differences in treatment of structures that L1 speakers disprefer or find infelicitous for the context.

1.3 Overview of the thesis

The thesis proceeds in the following manner. Chapter 2 is concerned with reviewing the background literature for the studies. It begins with a discussion of why adult L2 syntax might be different from that of adult L1 speakers who have learned the language in childhood. I discuss the idea of L2 optionality, the phenomenon whereby even advanced L2 speakers use inappropriate syntactic options in the target language. I then address established models of L1 language production, covering the basic architecture and describing in more detail structural aspects of production. I then review some of the psycholinguistic literature on L2 production, including descriptive models as well as experimental studies. The chapter finishes by introducing syntactic priming, an experimental tool for looking at sentence processing which is used in the majority of the experimental work of the thesis.

The next six chapters present a series of experiments investigating syntactic production in L1 and L2 speakers. Chapter 3 is mainly concerned with establishing a basic priming effect in L1 and L2 speakers of Spanish using active and passive structures, both in the absence and presence of lexical overlap across prime and target. The technique used is a dialogue game in which naïve participants interact with a confederate of the experimenter, who provides the primes. Chapter 4 presents an experiment aimed to remove social pressures on L2 speakers created by the dialogue context in Experiment 1, using the same materials in a computerised monologue situation. The results from Chapters 3 and 4 are very alike: a similar pattern of priming is seen in L1 and L2 speakers, including similar effects of lexical overlap, although priming is significantly stronger in the L2 speakers. This shows L2 speakers possess abstract syntactic representations, which are linked to specific lexical items, as has been suggested in L1 speakers. Surprisingly, there was no effect of L2 proficiency found in the results, despite participants lying across a range of intermediate to advanced L2 levels. I discuss how this contrasts with studies on child L1 priming, where results vary depending on stage of development, and this suggests a distinction in the way L1 and L2 learners acquire syntactic knowledge.

Chapter 5 addresses why stronger priming was found in L2 speakers relative to L1 speakers in the first two experiments. Possible explanations are presented, including that L2 speakers have weaker syntactic structure due to less exposure, or that they transfer preferences for structures from the L2 speakers' L1. Finally, it may be that L1 Spanish speakers resist priming of the passive because it is a rare and marked construction, whereas L2 speakers are less sensitive to syntactic constraints and as such are more susceptible to priming. I present an experiment distinguishing between these alternatives, using L2 speakers from different L1 backgrounds, and employing structures that are both acceptable for the L1 control group (PO and DO datives in English). Results show identical priming in L1 and L2 speakers from different L1 groups, pointing to the key factor in the first two experiments being L2 speakers lacking knowledge of the inappropriateness of the passive in Spanish, therefore showing more priming.

The results from Chapters 3 to 5 suggest a similar architecture is used in L1 and L2 sentence production, because similar priming and lexical boost effects are seen in both

groups. This was true for structures differing in terms of grammatical roles and hierarchical structures. However, it also suggests that L2 speakers have not acquired constraints on appropriate usage of syntactic structures, a finding that fits well with studies on L2 optionality.

Chapters 6 and 7 address L2 acquisition of lexical semantic constraints on choice of syntactic structure, and how this differs to in L1 speakers. In addition, they explore processing of linear word order, as opposed to grammatical roles or hierarchical structure. The issue addressed is that L1 Spanish speakers show different word order preferences dependent on the type of intransitive verb involved (unergative vs. unaccusative), while L2 speakers (with L1 English) have difficulty in acquiring native-like preferences. Chapter 6 discusses background theory about the different types of intransitive verbs, and then presents an off-line word order rating task, to establish basic word order preferences in L1 and L2 speakers of Spanish. As predicted, native speakers showed significant differences in their word order preferences dependent on the verb involved, while the non-native group showed no significant effect of the verb on their word order preferences. Chapter 7 explores this finding using syntactic priming in production. The study compares word order priming and lexical boost across L1 and L2 speakers, while varying the type of intransitive verb used in prime and target. I show that there are differences in the representation and processing of word order in the L1 and L2 groups. In particular, priming in L1 speakers is influenced by the preferences of the verb involved: when the verb used is infelicitous with a particular word order, L1 speakers are significantly less susceptible to both priming and a lexical boost than when that word order is acceptable with the verb class. In contrast, L2 speakers show no differences in their susceptibility to priming or a lexical boost dependent on the verbs involved. Therefore, although L2 speakers show grossly similar effects to L1 speakers in terms of word order processing, they have not fully acquired constraints on when particular word orders are appropriate for use or not, as reflected by susceptibility to priming. I also discuss how the finding of lexical influences on word order production in L1 speakers has implications for production models, which must be able to account for lexical information being available to word order processing.

In Chapter 8 I explore alternative explanations for the word order priming effect in Chapter 7, questioning the linguistic theory that different syntactic structures underlie the two types of intransitive verb. This issue is investigated experimentally by looking for word order priming when the prime and target verbs are from different lexical classes. Results show significant priming even when prime and target used verbs from different verb classes, and the effect was of equal magnitude regardless of the class of the prime verb. I therefore argue that the syntactic priming effect in Experiments 5 and 6 is one of linear word order, and that results show no evidence that different syntactic structures underlie production with unergative vs. unaccusative verbs. The results also suggest that the location of verb-specific effects on production lies in the preference of the target verb and not the prime verb. I discuss implications of this finding for explanations of syntactic priming in general.

The concluding chapter, Chapter 9, summarises the main findings of the thesis, and discusses directions for future research, including addressing priming in L2 speakers at different proficiencies, directly comparing production in L2 speakers with that in L1 children, and exploring L2 optionality in other contexts.

2 Review of the Literature

2.1 Overview

The aim of this chapter is to review the literature relevant to the current thesis. I start in section 2.2 by considering why language acquisition might be different in children and adults, with reference to the idea of a critical period after which a learner may never acquire a language to the same level as a native speaker. I also discuss the task facing an adult L2 learner in learning how to form syntactic structures in the new language. This section finishes by introducing the phenomenon of optionality, in which two syntactic possibilities are treated as being appropriate for a particular context. In L2 optionality, even very advanced L2 speakers may optionally use a syntactic structure that native speakers of the target language would not.

Section 2.3 outlines a specific example of optionality relevant to the thesis: word order choice in L1 and L2 Spanish. I describe how native Spanish speakers show different word order preferences depending on the intransitive verb involved in a sentence, and offer some psycholinguistic evidence for different processing of two groups of intransitive verbs. I then describe previous studies showing that L2 Spanish speakers do not show the same preferences as natives, and even at higher proficiencies overuse the inappropriate word order for a context.

The next two sections (2.5 and 2.6) deal with experimental research on language production, and models based on research findings. Section 2.5 introduces the characteristics of some well established models of L1 (monolingual) production, addressing the general structure of these models and the details specific to constructing syntactic structure. In 2.6 I turn to psycholinguistic models of L2 sentence production, which in large are adaptations of L1 models. Afterwards, I focus on existing on-line studies of L2 processing, looking at both sentence production and comprehension mechanisms in L1 and L2 speakers.

In section 2.7 I address the phenomenon of syntactic priming, which forms the basis of the experiments in this thesis. Priming is the tendency people have to repeat previously processed syntactic structures, and provides a real-time technique for investigating sentence production. I review the findings from previous syntactic priming

studies, and also address factors which are known to influence priming in L1 speakers. I finish this section by discussing findings of priming in different participant populations, which may have implications for finding priming in L2 speakers.

In section 2.8 I close with an overall summary of this chapter.

2.2 What must an L2 speaker acquire?

I begin the literature review by considering why it is interesting to look at adult L2 learners, and why the acquisition of syntax in a learner post-puberty might differ from normal L1 acquisition in children. By syntax, I mean the knowledge needed to generate grammatical sentences in a language (Hawkins, 2001).

2.2.1 L2 attainment: why might we expect L1-L2 differences?

I use the term ‘L2 speaker’ in the context of this thesis to refer speakers who have learned a new language as adolescents or adults, as opposed to during childhood (see Schwartz, 1998, on child L2 acquisition). The end-point of L1 acquisition is, by definition, the competence of (unimpaired) adult native speakers. An on-going question is whether or not adult language learners eventually acquire the same competence as speakers who acquired the language in childhood? Why might we expect differences in the way L1 and L2 speakers process the syntax of the new language, and in what ways might the end-point of this acquisition differ from the end-point of language acquisition in children?

Some researchers suggest that L1 and L2 linguistic systems may differ because the development of language, like the development of other cognitive systems such as vision, is dependent on a critical period. Under this argument, if language exposure begins after this period, the linguistic system will never reach the same level as L1 speakers who acquired that language in childhood (see Long, 1990, for a review). Some evidence for this comes from children who have been deprived of any language stimulus during their early life and begin learning a language at a later age. In these cases, delayed exposure results in difficulty in, or even the impossibility of, acquiring a grammar later in life (e.g., Curtiss, 1977)². Similarly, in the case of L2 learners, when the first consistent

² This difficulty cannot be unequivocally assigned to linguistic factors, however, because these children suffered deprivation in many additional ways.

exposure to the L2 occurs early on in life, the learner is more likely to achieve a native-like competence than those who learn it later on, in their teens or as an adult (e.g., Birdsong & Molis, 2001; Johnson & Newport, 1989).

Additional evidence for the critical period hypothesis comes from studies showing adult L2 learners to have persistent difficulties with the target language even after many years of immersion in, and exposure to, the L2 (e.g., Coppieters, 1987; Hawkins & Chan, 1997; Johnson & Newport, 1989; Lardiere, 1998; Sorace, 2000, 2003, 2004, 2005; Sorace & Robertson, 1999). Many of these studies require L2 speakers to make grammaticality judgments in the L2 and results are compared to those of natives. Interestingly, results differed between L1 and advanced L2 speakers mainly in contexts where a judgment required knowledge not only of the syntactic properties of the language but where these interfaced with lexical or pragmatic constraints³ (e.g., Sorace, 2005). I return to this in section 2.2.3.

The argument that adult L2 learners, past a critical period, do not have access to the same learning mechanisms for syntax as child L1 learners offers one explanation for why adult L2 speakers may show non-native behaviour. In addition, L2 speakers already possess a fully-specified L1 linguistic system and transfer of factors from the L1 may cause additional differences in the way L1 and L2 processing occurs. The extent to which L2 difficulties can be attributed to transfer from the L1 vs. general limitations of being an adult language acquirer is still an issue for debate (e.g., Hawkins, 2001).

So, if there is some evidence for differences between adult L1 and L2 speakers of the same language, in what ways might their syntactic production systems be similar or dissimilar? This issue has hitherto received little attention from a psycholinguistic perspective. I argue that by applying psycholinguistic experimental methods to L2 speakers we can reveal not only what representations underlie syntactic knowledge, but also how these structures are processed in real time. In this thesis I look specifically at the language production of L2 speakers who have learned the new language after the

³ The steady 'endstate' of L2 acquisition (i.e., a state which is assumed to be stable and from which no further changes in the L2 will occur) is in fact very variable, with great discrepancy in the performance of individual speakers. The term 'near-native' focuses only on those speakers who reach the level of attainment at which their speech is practically indistinguishable from that of a native speaker (e.g., Sorace, 2003; White & Genessee, 1996).

supposed critical period (e.g., 13-14 years old), assessing syntactic representations and processing using psycholinguistic methodology.

2.2.2 Structural aspects of language production

Let us now consider what L2 speakers must acquire in order to produce sentence structures in the same way as L1 speakers. Learning a new language requires an L2 speaker to acquire a variety of different constraints. For example, they must accumulate knowledge about the vocabulary of the new language including what words mean and how they are pronounced. They must also acquire the morphological aspects of the new language, for example how the language expresses grammatical concepts such as tense, case, gender or number. In addition, it is essential to know how individual lexical items and morphemes can be combined together into larger phrases and sentences. Structural knowledge involves learning not only the syntactic structures available in the new language, but also any constraints on when these structures can be used. In this section I summarise some of these factors.

Firstly, the L2 speaker must acquire the form of particular syntactic structures available in the new language, including the relevant function words and inflections. For example, to produce the passive structure in English one can use the syntactic skeleton '(noun phrase) is (passive participle verb) by (noun phrase)' as in *The doctor is hit by the granny*. The form of these structures may be similar across the learner's L1 and L2, e.g., Spanish allows a passive form similar to that in English. However, even when the surface structure is similar across languages, the morphophonological forms of those structures will still differ.

Secondly, L2 speakers must learn which word orders are available to them. Some word order rules are invariant. For example, Japanese requires the verb to always come at the end of a phrase, and German requires finite verbs to always appear in second position in main clauses but phrase-final position in subordinate clauses. In other cases word order is more flexible. For example, Turkish has very free word order allowing any permutation of constituent orders. In contrast, English has a fairly strict subject-verb-object (SVO) word order.

Thirdly, L2 speakers must learn when it is appropriate or ‘felicitous’ to choose one syntactic structure over another, or to use a particular word order. The felicity might be determined by the verb involved. For example, an intransitive verb can be used in a SV construction (*The doctor arrives*) but SV is ungrammatical with a compulsory transitive or ditransitive verb (e.g., **The doctor sends*⁴). Other rules about which constructions can be used with a particular verb will be idiosyncratic and must simply be learned; in English the ditransitive verb *give* can be used in both a prepositional object construction (*The doctor gives a book to his mother*) and a double object construction (*The doctor gives his mother a book*), while the semantically similar verb *donate* can only be used with the former construction (compare *The doctor donated money to the church* with **The doctor donated the church money*). Similarly, the choice of word order can also depend on the lexical items involved. An example of this is found in Spanish, and is explored in more detail in section 2.3.

A fourth factor determining native-like sentence production is knowledge of how discourse-pragmatic factors can influence which sentence construction is appropriate for a particular context. For example, Spanish allows flexible word order, but with a strong tendency to place focussed constituents (new information) in sentence-final position, and in Japanese topicalised constituents appear at the beginning of a sentence.

All these factors (and possible others, e.g., phonological aspects such as length of constituents) contribute to determining how a native speaker will construct the syntactic structure of an utterance. (How these factors are processed in L1 production will be addressed in more detail in section 2.4). In terms of L2 speakers, at various levels of proficiency they may have difficulties with any of these four structural factors. However, even advanced L2 speakers have particular difficulties with acquiring when it is appropriate to use one structure or another in the new language (the third and fourth factors described above).

⁴ As in standard linguistic notation, I shall use an asterisk (*) to indicate that a particular sentence is considered unacceptable by native speakers of a language, and a question mark (?) to indicate that a sentence is considered as sounding odd in that language.

2.2.3 Optionality

Having laid out the required knowledge for native-like sentence production, I now turn to the issue of optionality – a phenomenon that demonstrates differences between L1 and L2 syntax even at very advanced proficiencies.

Syntactic optionality is applied to situations when there are different ways of saying what seems to be the same thing, which show a clear correspondence in form (Mueller, 2000). A form of optionality is observed in native speakers of natural languages – there is frequently more than one structural option for expressing a particular concept⁵. For example in English the complementiser *that* can be optionally dropped, as in the sentences (i) and (ii).

(i) I know *that* Vicky is happy

(ii) I know __ Vicky is happy

Monolingual speakers therefore face choices in how they will express a particular meaning syntactically, although the choice may be influenced by various pragmatic or semantic factors in the context. Use of the term optionality in the field of L2 acquisition refers to when L2 speakers accept two syntactic options as being equally appropriate for a particular context, but a native speaker has a clear preference for only one of the alternatives. L2 optionality can be divided into two different types, depending on whether the ‘non-native’ option leads to a strong or mild violation of acceptability in the L2.

2.2.3.1 Hard constraints and L2 optionality

In some cases one of the L2 optional alternatives violates a grammatical ‘rule’ (or a ‘hard constraint’, Keller & Sorace, 2003, Sorace & Keller, 2005) in the target language, which would be judged as seriously unacceptable by a native speaker of that language. For example, English requires adverbs to appear after the direct object, as in (i) below, and find the word order in (ii) strongly unacceptable. However, French speakers learning L2 English may use and accept both these adverbial positions, optionally allowing the word order (ii) from their native language (e.g., Eubank, 1996; Prévost & White, 2000):

⁵ Some would argue that true optionality is not found in natural language, and that even the example given here differ slightly in their informational focus (cf. Müller, 2000)

- (i) Mary speaks English very well
- (ii) Mary speaks very well English

Similarly, German learners of L2 English may occasionally use a verb-second word order structure optionally in English (as in (iii)), instead of the appropriate counterpart in (iv) (Robertson & Sorace, 1999).

- (iii) For many kids is living with their parents a nightmare.
- (iv) For many kids living with their parents is a nightmare.

This type of L2 optionality has been shown in a variety of L1 and L2 pairings (e.g., Franceschina, 2001; Hawkins & Chan, 1997; Parodi & Tsimpli, 2005; Robertson, 2000).

So why does this type of optionality occur? Some researchers claim that L2 optionality is a part of the developmental process and will disappear as proficiency increases (Eubank, 1994; 1996; see Wexler, 1994, for an analogy with L1 acquisition), others claim it is permanent (e.g., Beck, 1998). Indeed, although adult L2 acquirers may use the incorrect option less frequently as development proceeds, the ungrammatical option may remain as a viable (if dispreferred) option in the mature L2 grammar. This is observed by the incorrect form not being rejected in grammaticality judgments, and occasionally surfacing in L2 speech (e.g., Sorace, 2003).

In addition, different theories have been proposed as to why persistent optionality is seen in L2 speakers. For example, some researchers claim that L2 speakers possess impaired grammatical representations in the new language (e.g., Beck, 1998; Eubank, 1996; Licerias & Díaz, 1999; Tsimpli & Roussou, 1990): L2 grammars lack specification in the functional features that govern syntactic processing. Other approaches claim that L2 speakers do not have representational impairments, but that problems arise in mapping those features onto surface realisations (e.g., Lardiere, 1998; Prévost and White, 2000; Robertson, 2000). Under this account, optionality does not result from deficits in syntactic representations, but from deficits in the procedures mapping the syntax onto surface morphology.

2.2.3.2 Soft constraints and L2 optionality

A different form of L2 optionality is found in cases where use of the 'incorrect' option results in only mild or intermediate unacceptability by native speakers of the

language (governed by ‘soft constraints’, Keller & Sorace, 2003; Sorace & Keller, 2005), not the categorical unacceptability seen in hard-constraint violation. In this type of L2 optionality, both the syntactic alternatives may be grammatical options in the target language, but L2 speakers violate lexico-semantic, pragmatic or discourse constraints on which of two options should be used. Papp (2000) refers to this as a *pseudo*-optional rule, because on the surface the two syntactic options might seem interchangeable, whereas in fact they are not free in alternation. Because the correct choice of syntactic structure involves not only syntactic knowledge, but integration with other types of linguistic knowledge, this is referred to as an ‘interface’ condition (e.g., Sorace, 2003). It results in the common observation by native speakers that the speech of an L2 speaker is not grammatically wrong, but sounds ‘unnatural’ such that a native speaker would phrase the same concept in a different way.

One example of this type of L2 optionality is found in the L2 acquisition of overt vs. null subject in Italian (Filiaci 2003; Sorace 2000, 2003, 2005). Null-subject languages like Italian offer the syntactic possibility of using an overt or null subject. However, there are discourse-pragmatic constraints on the appropriateness of each possibility (interface constraints). For example, an overt pronoun is appropriate when a shift in topic or a contrastive is focus required, but not when the topic is the same as in the previous discourse. In non null-subject languages like English (e.g., Chomsky, 1981; Rizzi, 1997) an overt subject is required because the lack of a subject is ungrammatical. English speakers of L2 Italian exhibit optionality by over-using overt pronouns, producing them in contexts where a monolingual Italian speakers would find this infelicitous (Sorace, 2003; Filiaci, 2003). The syntactic representations of these speakers may therefore be native-like (i.e., knowledge about the syntactic options of ‘null’ vs. ‘overt’ subject arguments), but where syntactic knowledge must be integrated with other areas of knowledge to process a structure, problems arise in the L2 speakers. This optionality cannot be explained simply as influence from the L2 speaker’s first language. Optionality in the use of overt pronouns is also seen in Spanish learners of L2 Italian, despite the fact that Spanish is also null-subject and has similar interface licensing rules on pronouns as in Italian (Bini, 1993, cited in Sorace, 2005). This suggests that the problem is not simply one of transfer of syntactic constraints from the L1 (e.g., that an overt pronoun is

obligatory in English), but of something inherent to the acquisition of a new language in adulthood.

A viable explanation for optionality of this kind is that L2 speakers lack knowledge of the appropriate felicity conditions licensing the use of one option versus another (e.g., Sorace, 2003, 2005). Use of the incorrect option is not a purely syntactic violation, but occurs at an interface level, where syntactic possibilities must be coordinated with discourse or semantic constraints in order to form a felicitous utterance. However, L2 speakers, possibly because of processing limitations, are unable to integrate this information in a native-like manner. So, it seems that aspects of syntactic production which rely to some extent on interaction with another linguistic domain are more vulnerable to incomplete acquisition, leading to residual optionality in L2 speakers.

2.2.4 Summary

In summary, the aim of this section was to introduce why adult acquisition of L2 syntax is of interest. I began by discussing the idea of a ‘critical period’, under which the ultimate linguistic attainment may be different in adults L2 language learners compared to in child L1 learners. I then introduced the important structural aspects which an L2 speaker must acquire in order to speak the new language like a native. Specifically, they must learn about the phrasal and word order options in the new language and how to form them, but also learn when it is appropriate to use one structure instead of another when two options appear to be available. This final issue has proved particularly difficult for L2 speakers to acquire. I then turned to the issue of optionality, a phenomenon in which the same thing can be said in different ways which show a clear correspondence in form. Optionality is observed in natural languages, in that there are frequently different structural options for expressing a particular concept. In addition, non-nativelike optionality is seen in L2 speakers. In some cases one of the options strongly violates a grammatical rule in the L2. However, one of the more persistent forms of L2 optionality is where the ‘incorrect’ option does not result in a strongly unacceptable construction for native speakers of that language, but results in an anomaly in terms of the pragmatics or lexico-semantics of the sentence. Having addressed the issue of optionality in general, I

turn in the following section to a specific example of L2 optionality: the effects of lexico-semantics on word order choices in L1 and L2 Spanish.

2.3 Word order in Spanish

The preceding section introduced the idea of optionality, both in L1 and L2 speakers. L1 speakers have a variety of syntactic structures available to them in their native language and there is often more than one structural possibility for expressing a particular concept. However, L2 speakers who have acquired the language after childhood often exhibit non-native optionality in that they treat two syntactic options as being equally acceptable for a particular context, where a native speaker would have a strong preference for one option.

In this section I consider this issue in more detail, with specific reference to word order in Spanish. This is an example where more than one structural option is available to native speakers, but choice of structure is constrained by the semantics of the verb involved and the pragmatics of the context. However, L2 speakers do not show nativelike sensitivity to these constraints, even when they have reached an advance proficiency level.

I begin by describing why the properties of intransitive verbs are thought to influence syntactic properties, a phenomenon termed split intransitivity. Linguists have traditionally divided intransitive verbs into two categories based on a variety of syntactic differences associated with the two groups. I then focus on how this influences Spanish word order preferences. This section finishes with a discussion of studies that have compared these preferences in L1 and L2 speakers of Spanish. In particular, L2 speakers, even at very advanced proficiencies, may continue to use the order which is inappropriate for that context.

2.3.1 Word order in Spanish and Split Intransitivity

Word order choice in Spanish is determined by a combination of lexical factors and pragmatic factors (e.g., Zagona, 2002; Zubizarreta, 1998). In a neutral ‘out of the blue’ the main verb can influence which word order L1 speakers prefer. For example, in answer to a non-focused⁶ question like ‘what happened?’, intransitive verbs such as

⁶ By non-focused I mean no focus placed on any particular element of the utterance.

gritar (to shout) require subject-verb (SV) word order, and verb-subject (VS) word order is considered infelicitous. These verbs are termed unergative. In contrast, with intransitive verbs like *venir* (to arrive) VS order is preferred and SV order sounds anomalous (Hertel, 2003; Zagona, 2002). These verbs are termed unaccusative⁷. However, pragmatics factors interact with this influence on word order. If the discourse introduces new information, the corresponding constituent is placed preferentially in sentence-final position (Zagona, 2002; Zubizarreta, 1998), with the consequence that both verb-types can be used with both word orders dependent on the context.

This example of an asymmetry between two types of intransitive verbs has been seen cross-linguistically across a variety of other syntactic behaviours (see Levin & Rappaport Hovav, 1995, for a review). Some linguists attribute the ‘split intransitivity’ to semantic differences between the verbs (e.g., Van Valin, 1990), such as the telicity and agentivity of the action the verb denotes. The single argument of an unergative verb (e.g., *shout, run, walk*) actively initiates or is actively responsible for the action of a verb, and the process described is usually atelic (no inherent endpoint). In contrast, the argument of an unaccusative verb (e.g., *arrive, die, leave*) usually plays a theme or patient role in the action, and the process described is telic (has an inherent endpoint). However, other linguists have argued the distinction between the two verb classes to be mainly syntactic (e.g., Burzio, 1986). The argument of unergative verbs is assumed to be external to the verb phrase (VP) (see Figure 2-2), and so syntactically equivalent to the subject of a transitive verb (Figure 2-1). The argument of unaccusative verbs is assumed to be internal to the VP (Figure 2-3) and so behaves syntactically like the direct object of a transitive verb (Figure 2-1). This results in unergatives and unaccusatives being underlain by different syntactic structures.

⁷ Verbs like *arrive* are also referred to as ‘presentational predicates’, because they introduce the existence or presence of the subject into the discourse (Zagona, 2002).

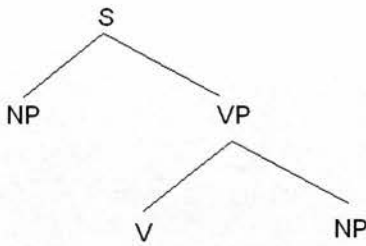


Figure 2-1: With a transitive verb (e.g., hit) the verb associates with a subject (external argument) and object (internal argument)

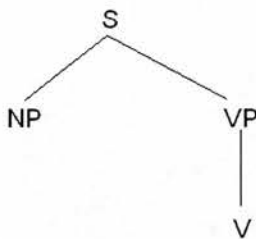


Figure 2-2: With an unergative verb (e.g., shout) the single argument is external to the VP, base generated in subject position.

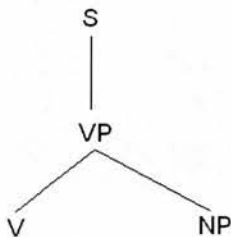


Figure 2-3: With an unaccusative verb (e.g., arrive) the single argument is internal to the VP, base-generated in object position.

For other researchers, the split intransitivity distinction is semantically determined but results in different underlying syntactic representations (e.g., Burzio, 1986; Levin & Rappaport Hovav, 1995; Perlmutter, 1978). Thus, processes controlling the projection of arguments onto syntactic positions are sensitive to a verb's semantic characteristics (Montrul, 2005). This idea was developed by Sorace (2000). She considered intransitive verbs not in terms of two discrete categories, but as sitting on a structured semantic hierarchy defined by the aspectual and thematic properties of the verb types (e.g., the extent to which the verb represents a change, and the degree of telicity of the change).

The syntactic correlates of a verb are determined by where it sits on the hierarchy: verbs lying at the extremes of the hierarchy ('core' verbs) show consistent syntactic properties traditionally associated with unergativity and unaccusativity, while more peripheral verb types (sitting closer to the centre of the hierarchy) exhibit more variability in syntactic correlates. Evidence for the hierarchy mapping onto native intuitions has been found in a variety of languages, including Italian (Sorace, 1993; 1995), Japanese (Sorace & Shomura, 2001), German (Keller & Sorace, 2003), French (Legentre & Sorace, 2003) and most recently Spanish (Montrul, 2005).

The syntactic difference offers an account for why unaccusatives are more acceptable with VS word order than unergatives, because VS maps onto the default deep structure of unaccusative verbs. This also implies that the same linear word order seen in sentences (i) and (ii) below is underlain by different syntactic structures, the key difference being that to create the surface structure in (ii) the single argument has moved from object to subject position, theoretically leaving a trace *i*.

- (i) The doctor shouted
- (ii) The doctor_i arrived *i*

In addition to the linguistic observations on split intransitivity, there is also some psychological evidence to support a cognitive difference between processing of the two verb groups. For example, Thomson (2003) found that agrammatic aphasic participants produced significantly fewer unaccusative than unergative verbs in a narrative task (and fewer than a normal control group), and also had significantly greater difficulty in producing descriptions involving unaccusative intransitives as compared to unergatives in a naming task. She explained this in terms of unaccusative verbs being syntactically more complex and requiring movement to produce SV order. In addition, there is on-line evidence suggesting the argument of unaccusative verbs is associated with a postverbal position. Friedmann, Taranto, Shapiro & Swinney (2003) investigated comprehension of intransitive verbs in English, by looking for evidence of a postverbal trace after an unaccusative verb in SV order. They used cross-modal lexical priming (Swinney, Onifer, Prather, and Hirshkowitz 1979), a technique based on semantic priming, i.e., that processing of a word is easier or faster when read or heard shortly after a semantically-related word. Participants hear a sentence including the verb of interest and at certain

probe points see a string of letters on a screen for a lexical decision (word or non-word). If a semantic priming effect is seen for a word related to a word earlier in the sentence, this is interpreted as this antecedent word having been reactivated at the trace probe position. Friedmann et al. (2003) found evidence for post-verbal reactivation of the subject of unaccusative verbs, but not unergatives, and took this as evidence for the argument of unaccusatives being base-generated in object position thus leaving a trace when it is moved to subject position. Similar cross-modal priming has been found for unaccusative verbs in L1 Spanish (Bever & Sanz, 1997; Montrul, 2004), suggesting the cross-linguistic psychological reality of this property.

To summarise, intransitive verbs are traditionally divided into two groups according to their semantic and/or syntactic properties. The two verb-types are hypothesised to be underlain by different syntactic structures at a deep level and the argument of unaccusatives is base-generated in object position, making a postverbal ordering more acceptable in the surface structure. This results in L1-Spanish speakers preferring VS word order with unaccusative but not with unergative verbs. There also appears to be behavioural evidence to supplement the theoretical linguistic approach to split intransitivity.

2.3.2 L1 and L2 Spanish word order preferences

As described above, constraints on Spanish word order preferences include both lexico-semantic properties of the verb involved and discourse-pragmatic factors. While the informational discourse effects on word order are language-specific, the phenomenon of split intransitivity described above is assumed to be a universal phenomenon (an innate ‘principle’; Chomsky, 1981). Indeed, the fact that syntactic correlates of split intransitivity have been demonstrated across a variety of different languages supports the universality of the distinction.

In English too, syntactic correlates have been proposed to be associated with each type of verb. For example, resultative phrases can be formed from the subject of passive (i) and unaccusative (ii) verbs, but not those of unergative (iii) verbs (e.g., Levin & Rappaport Hovav, 1995):

- (i) She was shaken awake by the earthquake
- (ii) The river froze solid
- (iii) *Dora shouted hoarse

However, English, unlike Spanish, only allows VS word order under certain conditions, e.g., when there is a locative or expletive present in preverbal position (e.g., *Into the room came the man* or *There arrived many students*)⁸. It appears in English there is therefore little opportunity for correlating word order with unaccusativity, and this must be acquired. Acquisition is complicated, however, by the distribution of word order in Spanish being a ‘poverty of the stimulus’ phenomenon (Lozano, 2003, 2006). On the surface the distribution of SV and VS word order with intransitives appears to be free, because both unaccusatives and unergatives appear with both word orders depending on the context. This makes the input ambiguous to the learner, who could assume that the alternation is truly optional (Papp, 2000). The factors determining word order are rarely taught in books or in the classroom, except for the interrogational subject verb inversion. In addition, the learner is unlikely to receive negative feedback about word order usage, because use of the inappropriate word order does not result in ungrammaticality but rather a pragmatic anomaly (Hertel, 2003).

Several studies have explored the use of SV and VS word order with intransitive verbs in L1 and L2 speakers of Spanish (de Miguel, 1993; Hertel, 2003; Lozano, 2003, 2006). L2 speakers tend to show more variable and less stable lexical preferences for word order than natives. A general pattern that emerges is that advanced L2 speakers of Spanish, for whom English is the first language, are more tolerant of VS order with unaccusatives than unergatives. However, they do overgeneralise the acceptability of VS to unergative, which in an unfocussed context is pragmatically strange.

Hertel (2003) studied production of SV and VS word order systematically using a contextualized production task. Participants were native Spanish speakers and English-speaking L2 learners at four proficiency levels (from beginners to advanced). Participants read a story in English to provide a context for the target sentence. In each story

⁸ Pinto (1997) proposed an explanation for subject-position in Italian based on verbs containing a locative element, not on the unaccusative-unergative distinction. She suggested that VS order in Italian may depend on the verbs’ argument structure containing a locative element (e.g., a ‘change of location’ verb like *arrive* or *leave* implies that the action happens somewhere). However, for the purposes of this thesis I will remain with the unergative-unaccusative explanation presented above.

something happens in the absence of one character and when that character returns, the reader must answer the absent character's question about what happened. Target structures included unaccusative and unergative verbs, and the question the returning character asks sets up different expectations for the information structure in the answer. For example, a question like *¿Qué pasó?* ('what happened?') is assumed to create a discourse-neutral interpretation, and because no information is focused a default word order is expected. This should evoke VS order with unaccusatives and SV order with unergatives for the native speakers. In contrast, a question like *¿Quién llegó?* ('who arrived?') places a focus on the subject, so a VS reply should be preferred regardless of the verb used. I will only discuss the results for the neutral-order condition, as this is the most relevant to the experiments to be presented in this thesis.

Hertel found low proficiency groups did not use VS order at all, presumably transferring the exclusive SV order from their English L1. With increasing proficiency learners showed a gradual increase in inverted structures, although the data were still indeterminate and variable. More proficient learners showed word order preferences with the correct trend, in that more VS structures were used with unaccusative than unergative verbs. Interestingly, however, advanced learners tended to overgeneralize the inversion to the unergative verbs in the study (proportion of VS produced with unergatives: 33% by advanced L2, 7% by L1; with unaccusatives: 56% by advanced L2, 29% by L1). The word order preferences exhibited by L2 speakers were therefore different to those in the L1 group, in particular showing variable behaviour at lower proficiencies, and over-generalising VS to unergatives at higher proficiencies (e.g., selecting VS word order more than native speakers would with unergatives).

This finding shows the characteristics of optionality. The language of L2 speakers at all levels is characterized by indeterminacy and treating two syntactic options as being appropriate in a particular context in a manner divergent from L1 speakers of that language (e.g., Sorace, 2003, 2005).

In a related study, Lozano (2003, 2006) used comprehension rather than production to look at word order preferences in both neutral and presentational focus contexts. Participants were native Spanish speakers, and English speakers with advanced L2 Spanish and they were instructed to read contexts which finished in a biasing

question, as used by Hertel (2003)⁹. They then saw two target sentences, each using the same intransitive verb in a different word order (SV vs. VS) and had to rate each as to how acceptable it was as a response to the context. Interestingly, Lozano obtained evaluations not only for the ‘appropriate’ word order, but also the alternative word order. Results showed the acceptability of SV order was similar across the English-L1 and Spanish-L1 groups for both unergatives (rated 85% acceptable by L2 speakers, 89% by L1) and unaccusatives (75% by L2, 63% by L1). Likewise, the acceptance of VS with the unaccusatives was similar in the two groups (87% by L2, 84% by L1). However, a key difference emerged in the ratings of VS word order with unergative verbs, which were rated significantly higher by the English L2 speakers than the native group (70% by L2, 47% by L1). Although the advanced L2 speakers of Spanish had acquired the correlation of SV/VS with the intransitive alternation (they preferred SV to VS with unergatives and VS to SV with unaccusatives in unfocused contexts), they also overgeneralised VS order to the unergatives.

Other studies on L2 acquisition of the unaccusative-unergative distinction support that learners do have knowledge of the distinction as demonstrated by studies on auxiliary selection (Sorace, 1993, 1995), causative errors (Montrul, 1999, 2001), quantifier floating contexts (Sorace & Shomura, 2001) and overpassivization (Balcom, 1997). As seen in the studies described above, the general preferences of L2 speakers may be in the right direction, and they can attain the broad distinctions. However, L2 knowledge may still be divergent from that of L1 speakers in terms of tending to overgeneralise a syntactic structure inappropriately (e.g., overgeneralising VS word order to unergatives). Indeed, L2 speakers show weaker intuitions than natives in general, and have difficulty in attaining finer-grained distinctions (Sorace, 1993).

Overgeneralization has been attributed to incomplete lexical L2 knowledge (e.g., Montrul, 1999; Oshita, 2001): lacking knowledge about the relevant lexico-semantic features of intransitive verbs, learners (especially early on) use a default syntactic structure template which they apply irrespective of the verb involved. This strategy is never completely overcome because non-native treatment of intransitive verbs is

⁹ Lozano also ran a Greek L1-Spanish L2 group, who produced similar results to the English L1 group. However, I do not discuss these results here as the experiments in the subsequent chapters concentrate on English L1-Spanish L2.

particularly noticeable even among upper-intermediate, advanced, and even higher proficiency learners (Oshita, 2001).

2.3.3 Summary

In this section I have introduced the theory of split intransitivity, which will be relevant for Chapters 6-8: intransitive verbs can be divided into two broad categories according to their semantics, and various syntactic differences are associated with the two groups. According to syntactic accounts, unergative and unaccusative verbs are underlain by different syntactic structures, and there is some psycholinguistic evidence for the two verb types being processed differently.

We have seen how split intransitivity manifests itself in word order preferences in L1 Spanish: post-verbal subjects are more acceptable with unaccusative than unergative verbs. Although L2 speakers of Spanish do appear to acquire this trend in general, at more proficient levels they tend to overgeneralise VS word to unergatives, which is infelicitous for native speakers.

More generally, L2 speakers' production of Spanish offers an opportunity to explore how the language production system represents and processes syntactic options. If L2 speakers show different preferences, this must reflect either different underlying representations or differences in processing intransitive verbs and word order as compared to L1 speakers.

2.4 Psycholinguistic models of L1 production

The previous sections addressed why we might expect differences between L1 and L2 speech, and introduced the issue of optionality. Linguists often attribute optionality and L1-L2 differences to differences either in representation (Beck, 1998; Eubank, 1996; Hawkins & Chan, 1997; Tsimpli & Roussou, 1990) or processing (e.g., Lardiere, 1998; Prévost and White, 2000; Robertson, 2000), without supporting this claim using on-line psycholinguistic data. I therefore now turn to psycholinguistic models of L1 language production. These are not theoretical linguistic models but are grounded firmly in experimental evidence and speech errors, and as such are designed to reflect cognitive processing. However, the vast majority of speech production models have been directed

at the adult monolingual (L1) system (e.g., Bock & Levelt, 1994; Dell, 1986; Garrett, 1980, 1988; Levelt, 1989). This is understandable when one considers that the task of describing speech production for one language is hard enough, with many of the processing details still under debate (Poulishse, 1997); attempts to describe a model involving two languages would complicate matters further. However, a first step would be to take established aspects of a monolingual model and see how far they can be applied to L2 production. Because the L1 models I describe are based on psycholinguistic experimental evidence, this motivates the need for similar research on L2 sentence production to justify the comparison.

I begin this section by describing the general structure of some established L1 production models, before turning to some details of production of particular relevance to this thesis. Specifically, what type of syntactic information is associated with particular lexical items, what factors are involved in building up the constituent structure of a sentence, and how do lexically-specific factors influence the construction of this constituent structure?

2.4.1 General structure of models of language production

There is broad consensus among psycholinguists on the basic architecture of L1 speech production, based largely on evidence from speech errors (e.g., Garrett, 1980, 1982, 1988), but also from results of psycholinguistic experiments (e.g., Bock & Levelt, 1994; Levelt, 1989). In the most highly articulated models (e.g., Bock & Levelt, 1994; Dell, 1986; Garrett, 1980; Levelt, 1989) the process of preparing to say a word proceeds through various stages, which can be grouped into three levels, or strata (see Figure 2-4, taken from Bock & Levelt, 1994). Firstly, at the conceptual level, a message to be expressed is formulated. This represents the initial meaning and communicative perspective of the intended utterance, and forms the input to a second level: the grammatical stage of processing. At this level, individual lexical items are selected and built into phrases and sentences according to the syntactic rules of that language. Thirdly follows a phonological level of processing, during which the sound structure of the computed utterance is realised, including both the phonological segments of words and the prosody of larger units. The result of the whole procedure is then sent to output

systems for articulation. In the current study I am particularly interested in how the grammatical stage proceeds, so I now discuss this component in more detail.

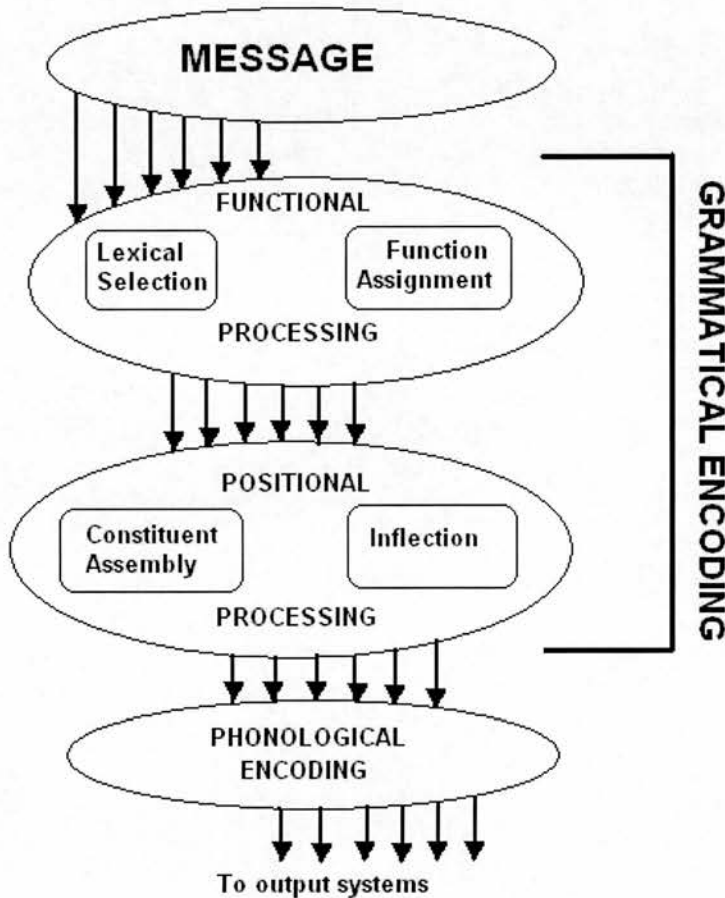


Figure 2-4: An overview of the language production system, adapted from Bock & Levelt, 1994

The grammatical component itself is traditionally divided into two subcomponents: functional processing and positional processing (e.g., Bock & Levelt, 1994; Garrett, 1980; Kempen & Hoenkamp, 1987; Levelt, 1989). The details of different models vary, however, so I focus on Bock and Levelt's description of the different stages, as depicted in Figure 2-4 (1994). During functional processing the lexical items associated with the intended message are identified and selected. The lexical entries selected at this stage are often referred to as lemmas in the language production literature, and are semantically and syntactically specified representations of the words available

(Levelt, 1989). When a lexical concept is activated at the message level, activation is assumed to spread to semantically associated concepts, e.g., the concept of SHEEP would also activate the concepts like ANIMAL and GOAT. Activation feeds forward from these concepts to the lemma stratum, where the syntactic component of each lexical entry is represented as a lemma. In the above example, this causes activation of both the lemma for *sheep* and, to a lesser extent, lemmas which represent semantically related words (e.g., *goat*). The most appropriate lemma is selected, based on an activation level criterion, e.g., to select the lemma with the highest activation relative to the total activation of all the lemmas in a set (Roelofs, 1992). Syntactic information associated with each lemma becomes available after lexical selection and can then be used to construct an appropriate syntactic structure. Whether or not this syntactic information is automatically activated following lemma selection is a matter of debate. For example, there is evidence that grammatical gender information associated with a noun lemma is only retrieved when required to produce an utterance (Schriefers, 1993). In a picture-word interference task Schriefers found that Dutch speakers were faster to produce phrases when a distractor word and the to-be-described picture were of the same gender compared to when they were of different gender, but only when participants produced phrases including a gender-marked element (determiner or adjective), not when bare nouns were produced. However, there is also evidence that structural information associated with particular verbs may be activated automatically, even when a verb is processed in isolation (Melinger & Dobel, 2005).

The other mechanism of functional processing is function assignment. This is where message elements are assigned grammatical functions (syntactic relations), such as Subject, Direct Object, Indirect Object, and are checked against grammatical features (e.g., to ensure that the head of the subject phrase is a noun). Function assignment has the first structural implications of language production, determining to some extent the final syntactic structure of the sentence. The output of functional processing is sent to positional processing.

Positional processing also involves both a lexical and structural component. During lexical retrieval, activation feeds from selected lemmas to activate the

corresponding phonological representation for each lexical entry, termed the lexeme¹⁰. The lexeme guides activation of required phonological elements. The phonological elements of grammatical morphemes such as function words and inflections must also be retrieved at this stage. In addition, the structural aspects of the final constituent structure are specified during constituent assembly. All constituents and inflected morphemes are placed in a hierarchical structure specifying groupings of words according to their syntactic functions. These are inserted into a frame specifying the linear word order of the structure.

I now examine in more detail three aspects of language production which will be relevant for the exploration in this thesis. Firstly, how combinatorial information is represented at the lemma stratum. Secondly, how and when different structural aspects of the final constituent structure are specified. Thirdly, what role lexico-semantic and -syntactic information plays in the specification of the final syntactic structure.

2.4.2 Syntactic information associated with the lemma

This thesis is concerned with the grammatical level of production and, specifically, how syntactic structures are associated with lexical items and constructed in real-time speech. The models cited above attempt to describe the whole process of language production from concept to articulation. Other researchers have concentrated on the specifics of lexical access in single word selection at the lemma level (e.g., Levelt, Roelofs & Meyer, 1999; Pickering & Branigan, 1998; Roelofs, 1992, 1993). I will now focus on the details of how lemmas and related syntactic information are retrieved and processed.

In order for a word to be placed in an appropriate syntactic context the processor needs access to all relevant syntactic information associated with the lemma for that word. This includes grammatical category (e.g., noun, verb), which grammatical functions it can take (e.g., subject, object), the types of syntactic structures it can occur in (e.g., noun phrase, verb phrase) as well as other features, which may be language-specific like grammatical gender (Levelt, 1989). Roelofs (1992, 1993) and later Levelt et al. (1999) described a model in which nodes representing lemmas are connected to a set of

¹⁰ There is some debate as to whether the distinction between lemmas and lexemes is needed in a model of language production – see Caramazza & Miozzo (1997) for an argument against the separation.

nodes which represent the associated syntactic information for that lexical entry. For example, all verb lemmas are connected to a node that represents the grammatical category of Verb, and in a language with e.g., masculine gender, all masculine nouns are connected to a node representing Masculine.

Pickering and Branigan (1998) suggested a conceptual expansion to this model, incorporating information about how individual lexical items might combine to form larger expressions, represented by combinatorial nodes (see Figure 2-5).

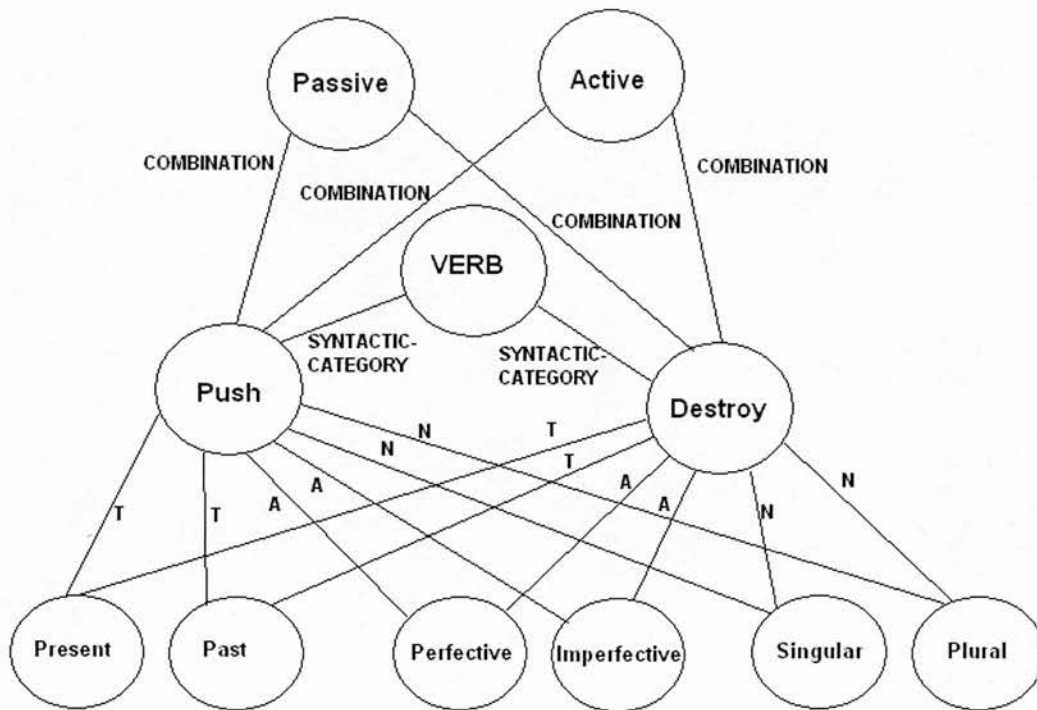


Figure 2-5: A partial model of the representation of syntactic information associated with verb lemmas in the production lexicon (adapted from Pickering & Branigan, 1998). The labels T, A, and N refer to tense, aspect, and number, respectively.

For example, the verb *push* can be combined with a single noun phrase (NP) in an intransitive like *the boy pushes*, or with subject and direct object NPs in a transitive active like *the boy pushes the bike*, or with a subject NP and prepositional by-phrase in a transitive passive construction like *the bike is pushed by the boy*. In Pickering and

Branigan's model, each structural possibility is captured by a combinatorial node corresponding to that construction. This combinatorial node is linked to each verb-lemma that can appear in that construction, e.g., *destroy*. When a verb is used in a particular construction, the relevant combinatorial node is activated. For example, when *push* is used in the passive construction, the information required to build passives is provided through joint activation of the node representing *push* and the node representing *passive*. This syntactic information is linked directly to lemma nodes, which represent the base form of a word, not a specific instantiation of that word. A similar model has been suggested for combinatorial information associated with nouns (Cleland & Pickering, 2003). I present evidence for this model in section 2.6, when I discuss priming studies. To date, these combinatorial nodes only represent different phrasal options in a language. The syntactic options of different linear word orders have not, however, been associated with lemmas. Indeed, word order information is often assumed to be processed at a subsequent stage in production, after lexical access (e.g., Bock, Loebell & Morey, 1992; Bock & Levelt, 1994).

Representing syntactic information as shared nodes linked to individual lemmas reduces representational redundancy. In addition, it captures the theoretical proposal that adult L1 speakers possess abstract representations of the combinatorial possibilities available in the language (e.g., Chomsky, 1965). Abstract representations would allow a language user to recognise syntactic relationships between sentences that share no lexical content. A speaker would also be able to easily apply a combinatorial rule to newly acquired vocabulary, despite never having experienced that word in that construction previously.

2.4.3 Combinatorial information: hierarchical structure vs. linear word order

The previous section described the idea that phrasal-structural information is associated with the lexical heads to which that structure can be applied to build up sentences. However, phrasal information is just one of the grammatical aspects that must be specified in a final syntactic structure (cf section 2.2.2), and in this section I consider the relationship between these structural aspects.

As described in section 2.5.1, the first step in producing a constituent structure is assumed to be the assignment of grammatical roles that each constituent will perform (e.g., Subject, Direct Object, etc.). Secondly, the hierarchical relationships between constituents must be specified, including phrase structure and dominance relations. This is the type of information captured by Pickering and Branigan's combinatorial nodes (Pickering & Branigan, 1998). Thirdly, the position of constituents must be fixed: the linear word order in which constituents will appear. Because there may be several options for each of these three aspects, syntactic optionality arises in L1 speakers: the same constituents can be combined into several different constituent structures, although each structure may bring slight changes in the focus of the message.

These three aspects of syntactic structure are often closely connected. Hierarchical relations are often determined by grammatical functions, (e.g., the subject role is associated with the head of the preverbal noun phrase), and in a language with fixed word order like English, the subject will nearly always appear in an earlier linear position than other grammatical roles. In addition, the specification of a structural aspect at one level may strongly constrain the structural choice at another level. If grammatical roles are assumed to be assigned early on in production (cf. Bock & Levelt, 1994; Levelt, 1989), this will strongly constrain the types of hierarchical structures which can then be built. For example, if the patient of a transitive action is assigned the subject function, the phrasal voice cannot be active and must be passive.

However, there are also cases where each aspect can influence the constituent structure independent of the others. For example, although hierarchical structure and grammatical functions place some restrictions on word order, linear order can vary independent of these features. Some languages, like the Algonquian language Odawa, allow great flexibility in the word order of constituents regardless of grammatical functions (Christianson & Ferreira, 2005). Even a language like English, with fairly strict word order, still allows some linear variation. For example, in addition to a canonical PO dative word order, if a dative takes a linguistically 'heavy' theme, the prepositional phrase can shift to a different linear position between the verb and the NP (compare the position of the prepositional phrase *to his patient* in *The doctor gave a prescription for*

the newest drug on the market to his patient with the shifted-structure *The doctor gave to his patient a prescription for the newest drug on the market*).

As described in section 2.5.1, language production models frequently make a distinction between functional and positional levels of grammatical processing (e.g., Bock & Levelt, 1994; Levelt, 1989). What remain uncertain are the details of exactly how and when the language processor deals with each structural aspect. For example, is there a unique stage of grammatical encoding which specifies linear word order, or are hierarchical and linear aspects specified at the same time? Some researchers argue that hierarchical relations and word order are specified concurrently (Bock & Levelt, 1994; Bock & Loebell, 1990; Bock, Loebell and Morey, 1992; Kempen & Hoenkamp, 1987; Pickering, Branigan & McClean, 2002). To take one example, Bock and Levelt (1994) propose that at the positional level both the hierarchical and linear aspects of the syntactic structure are constructed. Proponents of this view argue there is no strong evidence for separate stages and language production involves the mapping of a pre-syntactic information onto a single, fully-specified syntactic representation.

An alternative approach follows modern models of phrase structure grammar (e.g., Pollard & Sag, 1994) which propose that the processor constructs two representations in producing the final structural output. Initially, a phrase-structure representation is computed which is specified for dominance (i.e., hierarchical) and functional relations but not linear order. This then serves as the input to a process of linearization, during which linear word order is imposed on phrasal structures. Proponents of this view argue that the separation allows for incremental processing and so leads to more fluent production (e.g., Levelt, 1989; Vigliocco & Nicol, 1998). Hierarchical structures can be built as soon as the lexical heads are available, without waiting for all lexical heads to be prepared, and only afterwards given a position in the linear array. There is some evidence that the computation of dominance relations and linear order in production can be isolated from each other, both from speech errors (e.g., Garrett, 1980) and experimental investigation (Branigan, Pickering & Stewart, 1999 (cited in Pickering, Branigan, Cleland & Stewart, 2000); Hartsuiker & Westenberg, 2000; Pickering et al., 2000; Vigliocco & Nicol, 1998). For example, Vigliocco and Nicol studied the effect of linear distance on the distribution of subject-verb agreement errors:

the verb is separated from the head noun with which it must agree by an intervening head noun or pronoun with incongruent number, as in *The helicopter for the flights are safe*, and the verb is produced erroneously agreeing with the plural local noun *flights*. In two experiments they varied the linear distance between the local noun (in this case *flights*) and the verb: participants either completed sentences like *The helicopter for the flights...*, or produced questions, like *Is the helicopter for the flights safe?* The two structures do not differ in terms of syntactic relations between the local noun and the verb, but in the question structure the local noun is linearly further from the verb. Results showed a similar distribution of errors on the verb in both cases, leading to the conclusion that syntactic relations and agreement are computed in an initial stage of production, separate to and preceding linearization (although see Pickering et al., 2002). This approach predicts a syntactic skeleton is formed between the two stages which is not yet specified for word order, and allows for incremental processing to determine the order of the final output.

It therefore seems that although researchers of language production agree on the structural aspects which must be specified, there is not yet consensus on which stage these are specified.

2.4.4 Lexical effects on constructing a syntactic structure

As well as discussing *when* structural aspects are specified, another interest of psycholinguistic research has been to consider the influence of lexical factors on structural processing. By lexical factors in this context I refer to the semantic or syntactic features specific to a particular lexical item represented at the lemma level.

Lexical factors presumably affect certain aspects of production, but not others. In the models described in section 2.4.1 lexical factors are available during functional processing and could therefore influence grammatical function assignment. Likewise, lexical factors contribute to hierarchical structure because individual verbs (and other lexical items) specify their own subcategorisation frame. For example, an intransitive verb like *arrive* selects a single NP subject argument, while a ditransitive verb like *give* selects for three NP arguments. Syntactic properties of particular verbs therefore constrain the final hierarchical structure of an utterance.

It is less clear whether the specification of linear word order should be sensitive to lexically-specific information, because it is specified during positional processing when lexical retrieval has been completed (Bock, 1987, 1995; Garrett, 1988). In terms of semantic properties of verbs, some models propose that the construction of a structure during constituent assembly is insensitive to the meaning of lexical items, and only sensitive to form representations (e.g., Bock, Loebell & Morey, 1992). If meaning and phonological forms are indeed processed by separate mechanisms, there should be no effect of the meaning of a verb on the linear position of constituents within a phrase. Other models of language production allow for lexical factors to impact upon both grammatical function assignment and word order directly (e.g., Kempen & Hoenkamp, 1987; Levelt, 1989). For example, Kempen and Hoenkamp assign the mechanisms for computing word order to the functional stage, to occur at the same time as grammatical role assignment and lexical processing.

There is a body of experimental work that has investigated whether conceptual factors influence functional aspects of language production. There is evidence that, for example, inherently more accessible entities, such as more animate or concrete entities, tend to appear in more prominent syntactic positions than less-accessible entities that are inanimate or abstract (e.g., Bock & Warren, 1985; Christianson & Ferreira, 2005; Kelly, Bock, & Keil, 1986; McDonald, Bock, & Kelly, 1993; Sridhar, 1988). For example, Bock and Warren studied the effect of conceptual accessibility on the recalled position of NPs in a memory task. They presented participants with sentences containing two NPs within either a transitive (active or passive), a dative (PO or DO) or a phrasal conjunct structure (e.g., *The lost hiker fought time and winter*). In a subsequent recall task Bock and Warren found that with the transitive and dative sentences people often shifted more accessible NPs from lower to higher grammatical roles, so inverting the original grammatical role assignment (e.g., recalling *The shock was administered by the doctor* as *The doctor administered the shock*). However, the order of NPs within conjunctive noun phrases was not affected by conceptual accessibility, supporting that the conceptual effect was on grammatical role assignment, not serial ordering mechanisms. In English this also results in more conceptually accessible items appearing earlier in the sentence, but the results are interpreted as influence on grammatical role assignment, not linear word order. There is

some experimental evidence that in noun phrase conjunctions animate entities may tend to precede inanimates (Byrne & Davidson, 1985; McDonald, Bock, & Kelly, 1993), which cannot be an effect on grammatical roles, only linear word order. Byrne & Davidson found that in a free recall task children recalled an animate-inanimate order of names more easily than recalling inanimates first. However, this could be due simply to increased memorability of animate entities causing them to be recalled more easily. In addition, this offers evidence for conceptual features influencing word order at the within a noun phrase and not at the sentence level.

There is also evidence that the specific properties of verbs and the thematic roles for which they subcategorise can affect the final constituent structure, independent of the semantics of noun phrases involved. F. Ferreira (1994) used a production task to investigate how peoples' preferences for production of active versus passive constructions are influenced by the thematic roles the verb selects for. Participants were given a transitive verb and two nouns and were asked to construct a sentence, and the semantics of the verb were varied. Results showed that passive constructions were used more frequently with theme-experiencer verbs like *embarrassed* than with an agent-theme verb like *ignored* or an experiencer-theme verbs like *detested*. Ferreira explained this as speakers attempting to place more thematically-prominent constituents (agents, experiencers) in subject position. Because these are semantic properties, this provides experimental evidence that lexically-specific knowledge, and so lexical processing, influences the choice of constituent structure in production.

However, none of this demonstrates an independent role of lexical processing in *word order* production at the sentence level. In the studies described above, DO and PO datives differ in hierarchical structure, and actives and passives differ in both grammatical roles and hierarchical structure. One aim of this thesis will therefore be to look at the selection of two constituent structures which differ only in word order, keeping hierarchical structure and grammatical roles constant.

One previous study has addressed how syntactic properties of verbs influence word order directly, specifically the tendency to place long or "heavy" NP direct objects at the end of the sentence instead of in the canonical postverbal position (Stallings, MacDonald and O'Seaghdha, 1998). Stallings et al. used a constrained production

paradigm in which participants saw fragments of a sentence on a computer screen and were required to combine them together into a sensible sentence. Results confirmed that participants were more likely to produce a ‘shifted’ structure when the shifted noun phrase was relatively heavier. In addition, they investigated the effect of ‘shifting disposition’ on production of shifted datives. Verbs like *reveal* can appear in dative alternations but can also take a sentential complement, as in *Mary revealed [in a soft voice] that she was leaving her job*, in which context the verb can be separated from its complement (by the phrase ‘in a soft voice’). In contrast, verbs like *transfer* do not take sentential options and therefore have a lower shifting disposition. Results showed people rated *reveal* as more acceptable with an NP shifted structure than verbs like *transfer*. In addition, in a production task the authors found that the more frequently a verb appears in a position non-adjacent to its complement in a language (e.g., through sentential complements), the more likely that verb will be used in a shifted NP construction, not in canonical order. Stallings et al. concluded that a verb’s history of occurring with nonadjacent structures is represented with individual verbs, and this influences the extent to which the verb will subsequently engage in heavy-NP shift. Given that heavy-NP shift differs from the PO dative only in word order, this provides evidence for lexical factors being involved in establishing linear order of constituents.

To summarise, grammatical processing involves mechanisms specifying both lexical and structural aspects of the final utterance. The specific lexical (and syntactic) properties of individual verbs and noun phrases have been shown to influence both grammatical role assignment and hierarchical structure. What is still unclear is what part lexical factors play in the specification of linear word order and positional structure.

2.4.5 Summary

In this section I aimed to give an overview of psycholinguistic models of monolingual language production, models that are grounded in research on speech errors and controlled experiments. I then discussed in more detail the process of grammatical encoding which results in the construction of a fully-specified constituent structure. Specifically, I addressed how combinatorial information is associated with individual lexical items, at what stage different structural aspects of an utterance are specified, and

what influence lexically-specific factors can have on the final structure of an utterance. Having examined these processes in L1 speakers, the question still remains of how similar these processes will be in L1 and L2 speakers.

2.5 Psycholinguistic models of L2 sentence production

In the previous section I discussed models of L1 production and the processes involved in constructing a sentence, as well as some of the research devoted to studying those processes. However, all 'normal' language users are capable of developing and processing more than one language. Indeed, across the world, multilingualism is the rule and monolingualism the exception (Crystal, 1987). It has even been suggested that the processes involved in controlling bilingual¹¹ speech are also employed by monolinguals, in that all language users are capable of adapting their vocabulary choice depending on the interlocutor and the social situation involved (la Heij, 2005). For example, more formal words will be used in a job interview than in a relaxed social situation. If such an argument can be made about vocabulary, it could be extended to processing of syntax in two languages. The same speaker may choose to say 'I ain't doing that' or 'I am not doing that' depending on to whom they are speaking to. On this basis, a satisfactory model of production in monolinguals should also be applicable to bilingual production. This has also been discussed by Paradis (1987), who assumes no differences between the 'registers' used by a monolingual, and the 'languages' or 'dialects' used by multilingual speakers.

There are reasons to believe that L1 and L2 linguistic systems will show certain similarities, but there are also reasons for expecting differences between the systems (Jiang, 2000). Firstly, off-line evidence from L2 studies, including those on optionality mentioned above, have shown that L2 syntactic knowledge is somewhat different from that of native speakers, even at very advanced proficiencies (e.g., Johnson & Newport, 1989; Sorace, 2003). Secondly, the nature of input in the learning process is quite different in L1 and L2 speakers. If L2 speakers learn in a classroom setting, there may be a poverty of input in both quantity and quality compared to the amount of linguistic input

¹¹ Use of the term 'bilingual' tends to differ across the literature. Following de Bot (1992), I assume a bilingual includes anyone with knowledge of two languages at some proficiency, hence including unbalanced bilinguals who may have acquired an L2 later in life.

an immersed child receives. Thirdly, for L2 learners, the new language must be acquired on top of a pre-existing fully-developed linguistic system. For example, adult learners already have an established conceptual-semantic system, with an L1 lexical system closely associated with it. In contrast, children learning a first language develop their lexicon alongside the developing conceptual system. Likewise, syntactic routines have already been developed specific to the L1.

Compared to the wealth of research on monolingual sentence production, research on L2 sentence formation, and related models on this process, are more scarce. Psycholinguistic approaches to L2 speech have focused largely on the representation and processing of individual words (e.g., Costa, Miozzo and Caramazza, 1999; Gollan & Acenas, 2004; Kroll & Stewart, 1994). In particular, there has been an emphasis on whether lexical items of the two languages are stored in separate lexicons, or in one integrated lexicon, and whether lexical access is language selective or not. For example, Costa et al. (1999) used a picture-word interference paradigm to study whether words in a bilingual's two languages compete for lexical selection. Catalan-Spanish bilinguals named pictures in Catalan, while ignoring printed distractor words in either Spanish or Catalan. Amongst other results, they found similar facilitation of naming times when the distractor word was the Catalan name of the picture as when it was the Spanish translation equivalent. This was contrary to predictions from an interlingual competition model in which the translation word should interfere with naming, which lead Costa and colleagues to the conclusion that although words in both languages are activated in production, only target-language words are considered for target selection. However, there is also evidence that the non-target language can interfere with production in the target language (e.g., Hermans, Bongaerts, De Bot, and Schreuder, 1998; Poulisse and Bongaerts, 1994). Hermans et al. employed a picture-word interference paradigm in which L1 Dutch speakers were required to name pictures in their L2 English while ignoring distractor words. They found that naming a picture was slowed down by the presence of a distractor word in either their L1 or L2 which was phonologically related to the target's translation equivalent (e.g., *berg*). For example, naming a mountain (*berg* in Dutch) would be slower in the presence of a distractor like *berm* ('verge' in Dutch) or *bench* compared to an unrelated distractor. Because this effect was found even when both

distractor and target were in the L2 English, the authors interpreted this as evidence for the L1 translation equivalent of the target being active during lexical retrieval and competing for selection with the target. The presence of the distractors phonologically-related to the non-target translation boosted this activation so increasing competition.

Costa et al. explain the disparity between their results and those of Hermans and colleagues as differences in both the bilinguals' proficiency and in the response language across the studies. For example, they claim their Catalan-Spanish bilinguals to be much more proficient than the Dutch-English bilinguals in the study by Hermans and colleagues, and that any language-specific mechanism may be easier to apply in more proficient bilinguals.

Other researchers attempt to describe strategies of juggling and controlling two languages in a single mind (e.g., Green, 1998; Grosjean, 2001), or specifically to provide an account for code-switching phenomena (e.g., Grosjean, 2000, 2001; Myers-Scotton, 1993; Poulishse & Bongaerts, 1994). Many researchers assume that activation from the conceptual system feeds down to activate lexical items from both languages in a bilingual in parallel (e.g., Costa et al., 1999; Green, 1998; Gollan & Acenas, 2004). The question is then how to ensure words are produced in the correct language. One approach to regulation of this suggests that the activation levels of the language networks are modified in order to achieve regulation (e.g., de Bot and Schreuder, 1993; Green, 1998; Grosjean, 1998) as opposed to there being some simple on/off switch mechanism for the languages. For example, Green suggested inhibitory control in language production, such that although the conceptual system activates lemmas from both languages, language tags on lemmas from the non-target language cause inhibition of these potential competitors (e.g., 1998).

Whilst this research has produced interesting and informative results, there has been little attempt to address how lexical items are then assembled into syntactically felicitous phrases and sentences.

Some notable psycholinguistic L2 models have been proposed which do address the syntactic mechanisms involved in L2 language production (e.g., de Bot, 1992; de Bot & Schreuder, 1993; MacSwan, 2000; Myers-Scotton, 1993; Pienemann, 1998; Poulishse & Bongaerts, 1994). In this thesis I am concerned primarily with the representation and

processing of the syntactic information required to build up phrases from single words, so I will start with a review of the models of L2 production. I then address some of the psycholinguistic L2 research available on both comprehension and production at the sentence level.

2.5.1 Models of L2 language production

Few psycholinguistic models of L2 production have attempted to account for processing at the sentence level. There are some notable exceptions, which I review in this section.

Some L2 models are largely descriptive and speculative, offering a framework within which to explain L2 acquisition and processing, but lacking experimental justification. For example, Truscott and Sharwood Smith (2004) proposed an Acquisition by Processing Theory which describes the acquisition of a language (L1 or L2) occurs as a natural product of processing activity (following, e.g., Carroll, 1999). They argued for a shared processing system (including syntactic processor) for the L1 and L2, on the basis of parsimony and evidence of similarities between L1 and L2 acquisition. However, this leads in some cases to competition between the two knowledge bases within the same syntactic system, which causes L1-L2 differences. They also offer an account for how new syntactic structures can be acquired through input if no appropriate syntactic structure can be assigned to incoming phonological signal. The syntactic processor generates new syntactic representations by top-down processing from the conceptual system such that the new structure maps appropriately onto the thematic roles of the context. Once formed and accepted at the conceptual level this structure will remain in the linguistic system.

Truscott and Sharwood Smith's model has explanatory power for how new syntactic structures might be acquired, but is limited in terms of experimental data to support the claims and predictions for how L1-L2 differences will be reflected in behavioural measures. A more interesting model, which offers a direct comparison to the monolingual models described in section 2.4, was published by de Bot in 1992. This model was a direct adaptation of Levelt's (1989) model of language production. De Bot acknowledged that Levelt's unilingual system was based on several decades of psycholinguistic research and a wealth of empirical data and behavioural observations,

and so represented a viable cognitive model of processing. De Bot also recognized that, at the time, there was a lack of a bilingual model which would describe the entire language production process, integrating all the different aspects of the production process (from concept to articulation). Such a model should be able to accommodate the findings and approaches of linguistics, psycholinguistics, and social linguistics alike.

De Bot's use of the term bilingual was intended to include anyone with knowledge of two languages at some proficiency. The majority of bilinguals will have unequal command of the two languages they speak, and the model aimed to cover L2 learners as well as those with more balanced abilities in the two languages. De Bot addressed each stage of Levelt's model in turn, considering what adaptations are necessary for the bilingual version. This encompasses assumptions about a single conceptual system, common to both two languages (but see Kroll & De Groot, 1997; Van Hell & De Groot, 1998), as well as detailed discussion of the processes involved in lexical selection and application of grammatical and phonological rules. However, he does suggest that the information about which language is to be chosen will be included in the preverbal message, allowing for the choice of language to itself carry meaning in the way of communicative intent. This initial decision must then be capable of directing the language system to the appropriate vocabulary, syntax, phonetics, etc. of the chosen language.

De Bot considered the unilingual system as just one of the possible instantiations of the linguistic system, not the default. He therefore proposed little manipulation of Levelt's original model, but stated some additional assumptions to account for phenomena specific to bilinguals. For example, in a bilingual two language systems can be used entirely separately, or mixed, depending on the context in which the speaker finds themselves. The number of languages could also be potentially unlimited, without a significant reduction in the efficiency of the production system (which is not generally observed).

With respect to how the syntactic processing is organised in the bilingual system de Bot put forward two possibilities, either that there are two separate syntactic systems for each language, or that all the information about the syntax of different languages is stored in one system with language specific labels. If there is a separate formulator

(syntactic processor) and lexicon for each language, the two languages can be easily separated, with no need for a system controlling co-ordination of which language is to be used. However, this may also cause redundancy. He states that a probable solution would lie somewhere between these two extremes, in that some elements of grammatical information might be represented separately for an L1 and L2, and other aspects might be represented together. For example, he suggests that speakers would be more likely to use shared syntactic representations for their L1 and L2 when the L1 and L2 grammars were similar than when they were dissimilar. He also suggests that the tendency to share L1 and L2 grammatical systems will depend on L2 proficiency, presumably with the tendency to share being stronger in less proficient speakers than in more proficient speakers.

At the lexical storage level de Bot suggested a bilingual will have one lexicon, shared between perception and production, which consists of language-specific subsets containing items from only one language. The level of activation of the L1 and L2 subsets can vary and depends on which language is currently in use (cf Green, 1998, and Grosjean, 1998). As in the monolingual models described in section 2.4, activation from the conceptual level leads to retrieval of lexical items, or lemmas, along with syntactic information from that lemma. This syntactic information is necessary for the construction of surface structure, and he assumes language-specific lemmas, to account for syntactic differences there may be between translation pairs (e.g., different gender for the same concept in two languages).

In general, de Bot pays more attention to the question of how the lexicon is organized in terms of different languages, and how lexical selection is controlled, than to discussing how words are put together into phrases according to L2 grammatical constraints. This may reflect the lack of appropriate evidence to support any hypotheses about this level. He concludes the discussion of syntax by suggesting an extension of Levelt's model which includes a separate system for each language, including separate processing components in the formulators. There is also an assumption that syntactic processing in a bilingual will be similar in the two systems, but he does not explicitly discuss how this knowledge might be acquired by an L2 learner or change with proficiency.

The following year, de Bot revised the model in a co-authored book chapter (de Bot and Schreuder, 1993). The main change to the original was the explicit suggestion of language-specific formulators to process grammatical encoding, in order to account for how fluent code-switching can occur. The new model also included what they termed a Verbalizer between the conceptual level and the formulator which organises information from the preverbal message into lexicalizable chunks, so aiding more precise lexical access. Information about which language should be used is also found as a language cue in the preverbal message.

Because the amount of empirical data concerning bilingual language production is considerably less than that for the monolingual system, de Bot's model necessarily made speculations for which evidence is still sparse. He himself admitted that for certain components the relevant data needed to corroborate his model was still missing.

Several other researchers have adapted monolingual models for bilingual or L2 production and explicitly discussed syntactic processing. However, these are based mainly on code-switching data with focus on when and why bilingual speakers change language, either deliberately or unintentionally. For example, Myers-Scotton (1993) adapted models of speech production by Levelt (1989) and Garrett (e.g., 1975, 1982) to account for the structural constraints on intrasentential code switching. She postulated that one language will be the dominant 'matrix' language in conversations, and when there are insertions of morphemes from the other 'embedded' language this can only be along certain constraints. Another bilingual adaptation of Levelt's (1989) model was described by Poulishse and Bongaerts (1994), starting with the observation that bilinguals can both separate their different languages and also, at times, mix them, as seen in code switching, so both languages must always be activated to some extent. They assumed that information about the intended language of an utterance is stored at the message level, alongside activation of relevant semantic features, and that at the lexical level, both language alternatives will be activated to some degree. However, these are based on observations of language switching, as opposed to a bilingual speaking purely in the L2. In addition, the focus is largely on managing the two languages in a code-switching situation or avoiding code-switching, as opposed to discussing details of processing the L2 in monolingual mode.

A final model most relevant to the current thesis is an adaptation of Pickering & Branigan's combinatorial nodes model for the bilingual speaker (1998, see Figure 2-5) proposed by Hartsuiker, Pickering & Veltkamp (2004) (see also Hartsuiker, Schoonbaert & Pickering, to appear; Schoonbaert, Hartsuiker & Pickering, 2004). This model is firmly grounded in psycholinguistic evidence from priming studies, which I discuss further in section 2.6 below. To summarise here, priming is the phenomenon that people have a tendency to repeat the syntactic structure of an immediately preceding sentence. Hartsuiker and his colleagues also found cross-linguistic priming: if a bilingual had just heard a particular syntactic structure in one of their languages (e.g., a passive in Spanish), they tended to re-use that structure when speaking in the other language (e.g., a passive in English). To account for this they proposed that the bilingual system has language-nonspecific syntactic representations: combinatorial nodes representing syntactic structures are shared not only across lemmas within a language but also between languages. This is likely to require a clear correspondence in the surface form of the structures across languages, because Loebell and Bock (2003) in a similar study failed to find cross-linguistic priming for passive structures in English-German bilinguals and attributed this to the surface structure differing in the two languages. The models of Hartsuiker et al. (2004) and Schoonbaert et al. (2004) suggest that L1 and L2 production are underlain by similar architecture and processing mechanisms. However, the experimental evidence did not address syntactic production in a purely L2 context, only across languages.

In sum, it seems that, compared to the psycholinguistic models on L1 production, there are relatively few models directed at L2 sentence production. In addition, where these models do address the level of syntactic representation and processing they are often descriptive and speculative, because of the sparseness of appropriate supporting data. In the following section I turn to experimental data which is available about L2 syntactic processing at the sentence level, both in production and comprehension.

2.5.2 Psycholinguistic studies of L2 sentence processing

The previous section presented some psycholinguistic models of L2 sentence production, noting the need for more experimental evidence to confirm and develop such models. In

this section I review existing evidence from experimental studies that have looked at L2 sentence processing and compared it directly with that in L1 speakers, with respect to both production and comprehension. These studies have focussed on whether L2 speakers acquire processing mechanisms specific to the target language, transfer strategies from their L1, or apply parsing strategies not connected to either the L1 or L2. The findings to date are mixed. However, there is little evidence to support that L2 speakers acquire and apply the syntactic strategies of native speakers of the target language.

Before describing the available data on processing, I address the question of what insight experimental data can offer, and problems with only using data such as grammaticality judgements to assess linguistic systems.

2.5.2.1 Why use real-time experimental data?

The majority of work on L2 acquisition of syntax is based on off-line studies of syntactic competence, such as grammaticality judgments or diary data. While these techniques can explore the nature of linguistic knowledge and representations, they say little about processing, that is, how that knowledge is applied by the linguistic processor. In contrast, real-time experimental tasks offer the opportunity to study language-use during ongoing processing with real-time constraints. This can present a more cognitive and natural picture of language use. Although many L2 researchers have proposed theoretical models which make claims about language processing, I claim they can ultimately only be corroborated with experimental data.

The most widely used methodology in L2 studies on linguistic knowledge, is grammaticality judgment tasks. In a typical study, participants are given a list of sentences and asked to rate how 'acceptable' or 'grammatical' they find each as a sentence in the language in question. This method of assessment has advantages. For example, it is possible to collect data about constructions that might not occur often in spontaneous production. In addition, this minimizes the influence of any communicative needs, allowing the isolated study of structural properties (Schütze, 1996, summarised in Sorace & Keller, 2005). However, judgments can only assess linguistic competence indirectly, and may not necessarily tap into linguistic intuitions because assessments are open to conscious metalinguistic awareness of the rules of the grammar (Birdsong, 1989).

In addition, a range of factors in the presentation context can also influence judgments (Branigan, 1995). This includes conceptual factors: if you can imagine a context in which a sentence might be used, participants are more likely to accept a sentence as grammatical. In addition, comparison with other sentences can affect judgments: a borderline-grammatical sentence preceded by a strongly ungrammatical sentence is more likely to be judged as grammatical. To this end, Bard, Robertson & Sorace (1996) developed a new method for collecting judgments: the magnitude estimation task. This avoids the confound of previous sentences influencing the current judgment because participants are instructed to compare the current sentence to reference sentences in making their judgment, thereby setting their own scale of acceptability. However, problems with judgments are still found with this technique, and the results still cannot tell us about on-line processing of syntax, only about off-line knowledge.

In contrast, psycholinguistic studies in the last few decades have advanced hugely to include online methodologies including cross-modal priming, eye-tracking, self-paced reading and neuroimaging techniques (Marinis, 2003). The focus has been largely on monolingual processing, but has uncovered cross-linguistic differences in syntactic processing strategies. It can therefore be argued that it is not enough to test whether an L2 speaker has acquired the knowledge appropriate to the target language (which one could arguably do with grammaticality judgment tasks). If an L2 speaker is to produce native-like behaviour they may also have to acquire the processing strategies of the L2. Indeed, non-nativelike behaviour may result from processing deficits as opposed to failure to acquire linguistic knowledge (Marinis, 2003). I now review experimental studies which have compared L1 and L2 processing using such methods.

2.5.2.2 Experimental studies of L2 sentence processing

There is a growing body of experimental studies comparing L1 and L2 sentence comprehension, but comparatively few studies address production in the L2 (the concern of the current thesis). One study which has looked at production addressed processing of verb agreement in L1 and L2 speakers (Nicol and Greth, 2003; see also Nicol, Teller & Greth, 2001). As mentioned in section 2.4.3, these errors are seen when a verb is separated from the head noun by an intervening noun with an incongruent number,

leading to erroneous agreement (e.g., *The boy with the freckles are present*). Previous studies suggest that speakers of different languages compute agreement in different ways, because of cross-linguistic differences in factors influencing this type of agreement error. Specifically, Spanish (and Italian, French and Dutch) speakers are argued to be more susceptible to semantic factors when implementing subject-verb agreement (e.g., Vigliocco, Butterworth, & Garrett, 1996; Vigliocco, Hartsuiker, Jarema & Kolk, 1996) than English speakers (e.g., Bock & Miller, 1991). Speakers of these languages make more agreement errors in completing a preamble like *the picture on the postcards*, where the head noun *picture* is grammatically singular but conceptually plural (because there is more than one postcard, there must be more than one picture), than when the head noun is both grammatically and conceptually plural (e.g., *the key to the cabinets*). Nicol and Greth (2003) tested bilingual speakers in both their L1 (English) and L2 (Spanish) and looked at the nature of agreement errors produced by individual speakers in sentence completions. The results showed error patterns within an individual to be highly correlated in their two languages. The authors concluded that L2 speakers simply apply their L1 mechanisms of syntactic production when processing the new language, as opposed to adopting the processing strategies of native speakers of the L2.

In contrast to a neglect of experimental work on production, there has been a recent surge of interest in L2 processing in comprehension (e.g., Dussias, 2003; Felser, Roberts, Marinis & Gross, 2003; Hopp, 2004; see Clahsen & Felser, 2006, for a review). There is reason to believe that syntactic representations are to some extent shared across comprehension and production (e.g., Branigan, Pickering & Cleland, 2000), even if the procedures applied to them will differ depending on the direction of processing. Indeed, under psycholinguistic models like those of Levelt et al. (1999) and Roelofs (1992; 1993), the lemma stratum (where syntactic information is represented) is amodal, shared between comprehension and production. The L2 research on sentence processing in comprehension may therefore be relevant to processing in production.

Research has focussed on exploring whether L2 speakers parse the target language in the same way as native speakers of that language, and whether processing strategies are transferred from the L1 to the L2. Much of this work has taken well-established techniques from the L1 literature assessing on-line processing of ambiguous

sentences. For example, when a relative clause involves a complex genitive (NP-of-NP), as in the sentence *someone shot the servant of the actress who was on the balcony*, there is an ambiguity as to whether the final prepositional phrase *on the balcony* should modify the first NP (NP1, *the servant*) or the second NP (NP2, *the actress*). Attachment preferences can be assessed off-line by simply asking the participant a question like ‘Who was on the balcony?’. In addition, there are various on-line methods to assess attachment. For example, in a self-paced reading task participants read a temporarily ambiguous sentence in segments and at some point disambiguation is forced, e.g., by marking an auxiliary as plural or singular as in *The dean liked the secretaries of the professor who WAS reading a letter*. If the disambiguation is incongruent with the attachment adopted by the reader (e.g., the reader attached the continuation *who...* to the *secretaries*, but then encounter the singular verb *was* and must reanalyse as attaching the relative clause to *the professor*) they will experience processing difficulty causing longer reading times at that region compared to a control condition. Similarly, by monitoring eye-movements during reading, processing difficulty can be assessed as longer fixations or an increase in regressions at a crucial region.

L1 adult comprehenders are known to be sensitive to a range of different factors when resolving such structural ambiguities, including lexico-semantic information about the preposition or the thematic requirements and argument structure of the verb (e.g., Gibson & Pearlmutter, 1998). In addition, L1 speakers appear to apply certain syntactic strategies when integrating incoming words into a developing sentence and these strategies vary cross linguistically. L1 English speakers prefer an interpretation attaching the prepositional phrase to the NP2 (e.g., Carreiras & Clifton, 1999), adopting a syntactic principle of ‘recency’ which favours ambiguous phrases being attached to more recently-processed constituents. In contrast, native speakers of a variety of other languages tend to prefer NP1 attachment (e.g., French: Frenck-Mestre & Pynte, 1997; German: Hemforth, Konieczny, & Scheepers, 2000; Greek: Papadopoulou & Clahsen, 2003; Spanish: Cuetos & Mitchell, 1998). This is attributed to a principle of ‘predicate proximity’ in which the syntactic constituent closest to the predicate receives the attachment of ambiguous modifiers. Because this is well-established L1 behaviour, which varies cross-

linguistically, it offers the perfect context in which to study L1 vs. L2 processing strategies.

L2 syntactic ambiguity resolution has been investigated using a variety of L1/L2 combinations with highly-proficient learners. The general conclusion from self-paced reading tasks is that L2 adult learners fail to acquire native-like preferences for attachment (e.g., Dussias, 2003; Felser et al., 2003; Papadopoulou & Clahsen, 2003). Some studies found non-native speakers had no preference for either NP1 or NP2 attachment (Felser et al., 2003; Papadopoulou & Clahsen, 2003). This was interpreted as L2 speakers not applying any syntactic strategy to resolve the phrase-structure in the way monolingual adults are claimed to. For example, Felser and her colleagues (2003) looked at the attachment preferences of advanced L2 English speakers with Greek-L1 and German-L1. They used complex genitive sentences and varied the preposition preceding the NP1 to be either *of* or *with* as in (i) and (ii) below:

- (i) The dean liked the secretary of the professor who was reading a letter
- (ii) The dean liked the secretary with the professor who was reading a letter

With sentences like (i) the L2 speakers demonstrated either NP1 or NP2 attachment around 50% of the time (i.e., no preference). This cannot be explained as difficulty in on-line processing, because similar results emerged in an off-line assessment of preferences. Interestingly, the L2 speakers were applying neither the attachment strategy from their native language, nor that from the new language, but rather did not appear to be applying any syntactic strategy. The effects cannot be explained by transfer or interference of L1 strategies on L2 processing, because similar findings emerge when the L1 and L2 both prefer NP1 attachment. For example, Papadopoulou & Clahsen (2003) looked at attachment preferences of Spanish-L1, German-L1 and Russian-L1 learners of L2 Greek. The L2 speakers also showed no consistence preferences at all when reading complex genitive relative clauses. Interestingly, despite not showing consistent syntactic strategies their L2 speakers did appear sensitive to the lexical semantics of the preposition in parsing. As found in L1 speakers, the L2 speakers strongly preferred an NP2 attachment in sentences like (ii) which uses an NP2-biasing preposition.

Other researchers looking at L2 parsing of ambiguous sentences have found different results. Dussias (2003) used a self-paced reading task and found NP2 attachment for both L1 English-L2 Spanish and L1 Spanish-L2 English speakers in both their languages (on- and off-line). She explained this as the bilingual language processor experiencing additional cognitive demands compared to the monolingual language processor. Late closure (NP2 attachment) is therefore adopted as the least costly processing strategy, allowing immediate integration of new material without putting a extra cost on memory.

One study which did find native-like attainment was an eye-tracking study by Frenck-Mestre & Pynte (1997). They showed native speakers of English with advanced L2 French performed syntactic analysis similar to that of French-L1 speakers (favouring NP2 attachment). They also found L2 speakers to be sensitive to constraints on plausible syntactic structures from verb subcategorization information (e.g., how many arguments the verb should take). Interestingly, the L2 speakers reading in the L2 showed non-native behaviour in cases where the L1 *translation* of the verb constrained possible continuations but the L2 verb did not. For example, the verb *obey* is optionally ditransitive in English, making the phrase *the pretty little girl* in (iii) temporarily ambiguous between a direct object and subject of a new clause. In French *obéir* is intransitive so no ambiguity should be created in (iv).

(iii) Every time the dog obeyed the pretty little girl showed her approval

(iv) *Chaque fois que le chien obéissait la jolie petite fille montrait sa joie*

In Frenck-Mestre & Pynte's results, L1 English-L2 French speakers showed difficulty at the main verb of the sentence (*montrait*) when reading the sentence in French, while the monolingual French speakers had no such difficulty. It therefore seems that even in cases where native-like structural principles are acquired in an L2, lexically-specific structural constraints from the L1 may still be transferred.

A final study I review here relates to processing of the unergative-unaccusative distinction in L1 and L2 Spanish sentences. As mentioned in section 2.3.1, L1 speakers of both English and Spanish show sensitivity to a difference between unaccusative and

unergative verbs in cross-modal lexical priming tasks (Bever & Sanz, 1997; Friedmann et al., 2003; Montrul, 2004). In L1 studies, semantic priming to the probe word has been found when the verb was unaccusative but not when it was unergative. Bever and Sanz found only a subset of the Spanish participants actually showed this effect, those who were judged as being 'sequence-sensitive' and paying attention to the structure of the sentence, not just the semantics. Montrul (2004) directly compared this processing in Spanish using native speaker participants and intermediate-advanced L2 Spanish speakers (L1 English). Interestingly, both the L1 and L2 speakers showed similar results to those in the Bever and Sanz study, with a subset of syntactically-aware participants showing differential priming depending on the verb involved. Montrul concluded that L2 speakers of Spanish are also sensitive to the distinction between unergative and unaccusative verbs, and process these verbs in similar ways to L1 speakers.

Although there is some evidence for L2 processing matching that in L1 speakers, the majority of studies on L2 processing suggest that while native speakers of a language apply certain syntactic processing strategies in analysing incoming speech, L2 speakers do not consistently apply such syntactic strategies, even when their L1 and L2 use similar strategies. Similar results have been obtained in studies on morphological processing using event-related brain potentials (ERPs), and on studies on filler-gap dependencies using cross-modal priming (see Clahsen & Felser, 2006, for a thorough review). It appears that L2 speakers may be less sensitive to syntax-guided comprehension in their second language than native speakers.

One explanation for these findings proposed by Clahsen & Felser (2006) is that L2 speakers compute shallower and less detailed syntactic representations during language comprehension than adult L1 speakers. This is based on the observation that L2 speakers, when faced with an ambiguous input, are sensitive to lexico-semantic cues which would aid resolution. In contrast, in many cases L2 speakers do not appear to apply syntactic strategies to parsing in comprehension, as has been observed in adult L1 speakers. Instead, L2 speakers seem to rely on non-structural information (e.g., semantic context).

In conclusion, experimental studies on processing have not shown evidence for L1 sentence-processing strategies interfering with L2 processing, but neither does L2 processing appear to be similar to native processing.

2.5.3 Summary

To summarise this section, monolingual models of language production have been adapted to accommodate the L2 or bilingual speaker. However, either these models do not tackle how syntactic production occurs at all, or, if they do, the claims are not supported with experimental evidence as monolingual models have been. If it can be shown that L2 speakers behave in a similar way to L1 speakers on certain behavioural measures, then this would suggest that a similar processing system is underlying L1 and L2 production.

There have been some experimental studies comparing sentence processing in L1 and L2 speakers, mostly notably in comprehension. The general impression from these studies is that L2 speakers apply different processing strategies to sentences in the target language than native speakers of that language. The work I will present in this thesis adds to this work on sentence level computation, comparing both representation and processing in L1 and L2 speakers. In the next section of this chapter I introduce the experimental technique on which the experiments in this thesis are based: syntactic priming.

2.6 Syntactic priming: a technique for investigating sentence production

In the course of this chapter we have seen that a persistent problem even in advanced L2 speakers is in selecting the appropriate syntactic structure for an utterance. We have also seen that within linguistics there is a lack of experimental evidence exploring the L2 syntactic system, and within psycholinguistics there are few studies looking specifically at sentence level production in L2 speakers. Studies on L2 processing largely suggest that L2 speakers do not acquire native-like syntactic strategies.

In contrast, it has been possible to build up detailed models of L1 production on the basis of psycholinguistic evidence. The aim of this thesis is therefore to apply an established experimental production task to L2 processing, in order to compare L1 and

L2 production directly. Priming tasks have been used extensively in studies of grammatical encoding to elucidate the representations and mechanisms involved in producing a syntactic structure. At the same time, priming also relates to issues of optionality, because it is found in cases where two syntactic structures are available to a speaker to express the same message in a language, and is a way of assessing the level of production where syntactic structure is selected and constructed.

2.6.1 Isolating syntactic processing with priming

When a message is converted to articulated sound, at some point in the process a syntactic structure must be selected and built. What determines the final syntactic structure of an utterance constructed by a speaker? This is to a certain extent determined by conceptual factors. For example, the number of participants in an event will influence the number of arguments a verb requires. In addition, factors like conceptual accessibility of nouns can also influence functional assignment (as described in section 2.4; see Vigliocco & Hartsuiker, 2002, for a review) and because grammatical functions partly determine a syntactic structure, it follows that conceptual accessibility also affects the final structure which is chosen.

However, there is also evidence that production of syntactic structures is to some extent independent of the lexical items involved. This comes from studies demonstrating that abstract knowledge of syntactic constructions can be independently primed: people are more likely to use the structure of a previous sentence than an alternative. Comprehension or production of an utterance is facilitated by previous comprehension or production of an utterance with the same (or a related) syntactic structure (see Pickering & Branigan, 1999, for a review). This effect is termed syntactic priming or structural persistence. Early mention of this persistence effect came from observations of spontaneous speech (e.g., Levelt and Kelter, 1982; Weiner and Labov, 1983). For example, Levelt and Kelter (1982) phoned up hundreds of shopkeepers in the Netherlands and asked them (in the Dutch translation) either “At what time does your shop close?” or “What time does your shop close?”. The answers they received tended to conform to the structure of the question. Following the former question, starting with a prepositional phrase, people tended to answer “At five o’clock” but when the question

only contained a simple noun phrase more answers of the type “Five o’clock” were seen. It can be argued that this was a lexical-persistence effect, due to priming of the lexical item *at* (and the authors in fact interpreted the repetition as a tendency to reuse specific words) but there is also a difference in syntactic structure associated with the presence or absence of the preposition.

In another seminal study, Bock (1986) demonstrated similar effects experimentally using a running recognition memory task. Participants initially studied a set of sentences and pictures. In a subsequent test-phase they then repeated sentences and described pictures, saying whether or not they recognised each from the study phase. The sentences acted as primes and varied in their syntactic structure, and the dependent variable was the structure of the picture descriptions produced. Results showed speakers were more likely to describe a picture using an active structure (e.g., *The alarm clock is waking the boy*) if they had just repeated an unrelated sentence with an active structure (e.g., *The lightning struck the church*) than if they had just repeated a denotationally equivalent sentence with a passive structure (e.g., *The church was struck by lightning*). Likewise, she found people were more likely to repeat a prepositional dative structure (e.g., *The man is reading a story to the boy*) following a prepositional dative prime (e.g., *A rock star sold some cocaine to an undercover agent*) than a double object dative prime (e.g., *A rock star sold an undercover agent some cocaine*). Bock explained this finding as the prior production of a particular syntactic form leading to increased activation of the procedures controlling production of that form, relative to the procedures responsible for an alternative form. This enhances the likelihood of their re-use. Interestingly, she describes this as activating ‘operations’ responsible for processing syntactic structure. In contrast, researchers like Pickering and Branigan (1998) talk about ‘representations’ of syntactic structures. However, the descriptive term is less important than the idea that persistence occurs at the stage in production where syntactic structure is formulated.

Subsequent studies on syntactic priming offer more evidence that the effect was due to persistence of the syntactic structure and not some other factor. For example, the effect cannot be attributed to lexical priming because it occurs in the absence of lexical overlap between prime and target. Bock (1989) found that production of prepositional-object sentence like *the girl handed the paintbrush to the man* was primed equally well

whether the prime and target used different prepositions, as in *the secretary baked a cake for her boss*, or the same preposition, as in *the secretary took a cake to her boss*. In addition, Bock and Loebell (1990) tried to rule out an explanation in terms of overlap in metrical structure repetition. They found that a sentence like *Susan brought a book to study* did not prime usage of a prepositional dative phrase, despite metrical similarities between the two forms. Finally, semantic overlap or overlap in thematic roles is not necessary to see the priming effect. Bock and Loebell demonstrated a priming effect from prepositional phrases specifying locations, e.g., *the wealthy widow drove her mercedes to the church*, to prepositional object dative descriptions, which do not refer to a location, e.g., *a rock star sold some cocaine to an undercover agent*. Both primes have similar structural configurations but differ in event roles: the dative prepositional object represents a thematic recipient, whilst the locative prepositional phrase encodes the location of the action.

In the same study, Bock and Loebell showed priming occurred even when the thematic roles were different across prime and target. They demonstrated priming of passive structures by sentences using locative by-phrases, like *the 747 was landing by the control tower*. Interestingly, the locative primed a passive target equally as effective as a passive prime like *the 747 was alerted by the control tower*. The two types of primes share a phrasal structure (NP[AUX V [P NP]_{pp}]_{np}) but have different constituent roles, because the subject of the locative sentence is an agent while the subject of a passive is a patient. Despite the difference in constituent roles, passives and locatives were equally effective primes for a passive target, suggesting that the structural repetition is not the result of thematic role positions persisting. Instead, the persisting structure seems to be phrasal in nature.

An important implication of these studies is that syntactic processing can be isolated from other factors in language production. For example, because syntactic priming occurs independently of conceptual processing, this is evidence against syntactic structure being simply a result of specifications at the message level.

In the years following these studies, syntactic priming effects have been demonstrated using a variety of other methods such as written and spoken sentence completion (Branigan, Pickering, Stewart & McLean, 2000; Pickering & Branigan, 1998;

Hartsuiker & Westenberg, 2000), sentence recall (Potter & Lombardi, 1998) dialogue (Branigan, Pickering, & Cleland, 2000), and internet based-tasks (Corley & Scheepers, 2002). Priming occurs with many different types of constructions including noun phrases (Cleland & Pickering, 2003), order of verb and auxiliary in Dutch subordinate clauses (Hartsuiker & Westenberg, 2000), and even the presence or absence of the complementiser 'that' (Ferreira, 2003a). Priming has been shown in languages other than English, for example Dutch (Hartsuiker & Kolk, 1998a) and German (Scheepers, 2003). Priming has been shown not only from production to production (e.g., Bock, 1986) and comprehension to comprehension (Branigan, Pickering & McLean, 2005; Scheepers, 2003), but also from comprehension to production (e.g., Branigan et al., 2000). This suggests that similar syntactic knowledge is involved in syntactic processing in both comprehension and production. It also supports the suggestion that the priming effect is not merely concerned with the procedures underlying production, but rather taps into linguistic knowledge, with patterns of priming being informative about the nature of underlying syntactic representations (Branigan, et al., 1995).

The term syntactic priming has been used to cover priming of any aspect of syntactic construction, including phrasal structure, word order and even the presence or absence of a function word. Indeed, priming offers a technique for assessing whether a particular syntactic factor (e.g., phrasal structure or word order) plays an important role in structural processing in language production. If a particular syntactic aspect is independently primable, this priming effect can be attributed to the persistence of a specific, isolatable mechanism for processing that aspect. In addition, various factors have been found to manipulate the syntactic priming effect in an independent manner, which again indicates that processing of that factor occurs at the same time as structural specifications.

2.6.2 What causes syntactic priming: implicit learning vs. activation accounts?

The precise mechanisms that underlie the effects of syntactic priming are still not clear. However, there are two broad explanations for what the syntactic process which is primed entails: long-term implicit learning vs. (or in addition to) transient changes in

activation levels of representations. Both accounts are currently able to explain most of the available data about priming, but each has its own specific predictions.

Under an implicit learning account (e.g., Bock & Griffin, 2000; Chang, Dell, Bock & Griffin, 2000; Ferreira, 2003a) priming involves adjustments to the processes involved in mapping a particular conceptual message onto a syntactic structure. The structural procedures involved in production of a syntactic structure can be strengthened, causing a procedure to be more likely to be used in producing subsequent messages of the same type. This leads to long-term adjustments in the production system, so the same mapping operations will subsequently be faster, better and more available. Support for the implicit learning accounts comes from the finding that priming is preserved in anterograde amnesia, and as such attributable to implicit learning (Bock, Ferreira, Cohen, & Wilson, 1998, cited in Bock & Griffin, 2000). In addition, priming occurs incidentally, when participants do not recognise the experimental manipulation causing it, and the processes involved in constructing sentences are normally outside awareness (e.g., Bock & Griffin, 2000). Finally, there is evidence that priming effects are relatively long-term (Bock & Griffin, 2000; Boyland & Anderson, 1998; Hartsuiker and Kolk, 1998; Hartsuiker, Kolk & Huiskamp, 1999).

An alternative account explains priming as residual activation in syntactic representations, as a consequence of the architecture of the language production system (e.g., Pickering & Branigan, 1998). Under this account, when the representation of a candidate structure is selected for use there is a temporary increase in its activation level. Selection is then based on the level of activation of a lexical node (e.g., the representation that reaches a critical value first, or the node with the highest level of activation at a certain time step). However, it takes time for this activation to decay, and residual activation increases the likelihood of subsequent selection of the same syntactic representation. In the case of syntactic priming, an increase in activation of a combinatorial node would result in the structure being more accessible than alternatives and more likely to be reused (either because it reaches a threshold level first, or in a competition model because it is most highly activated at a critical timestep). This also predicts that the activation should dissipate fairly quickly in order to allow new information to be processed by the system. In support of this theory, there is some

evidence for priming being a short-term effect and for intervening material interfering with the effect (e.g., Levelt and Kelter, 1982; Branigan, Pickering, and Cleland, 1999). In addition, there is evidence for the priming involving amodal representations associated with lexical items, as opposed to a set of procedures involved in mapping from conceptual features to syntactic structures. For example, priming can be found from comprehension to production (e.g., Branigan et al., 2000), which is hard to account for in terms of production procedures. In addition, priming has been shown even when no syntactic structure is present in the prime (Melinger & Dobel, 2005). Melinger and Dobel presented participants with single word primes which could only be used with one syntactic structure of an alternating structural pair, e.g., the verb *to fine*, which can only be used in a DO form, and not PO. In subsequent utterances, they found participants were more likely to use the form with which the prime word could be used (i.e., DO if the prime were *fine*) than the alternative (i.e., a PO). They interpreted the finding as evidence for priming being an increase in activation of combinatorial features connected to specific lemmas. Finally, the implicit learning account of syntactic persistence, in which syntactic knowledge is not linked to specific lexical representations, cannot account for the fact that repetition of lexical items across prime and target can boost priming effects.

It may be that both mechanisms are involved in priming: there may be an element of short-term activation of syntactic representations, which decays with time, but the activation may never return to the original baseline resulting in an incremental long-term learning effect.

In the sections that follow I present more details about syntactic priming studies, relevant to the current thesis. Chapters 3-5 will look at priming of actives and passives or dative constructions, as described for Bock (1986). However, Chapters 7 and 8 look at word order priming (pre- vs. post-verbal subjects in Spanish), so I begin by looking in more detail at studies of priming linear word order. I then discuss some factors which are known to affect syntactic priming. Finally, syntactic priming has not previously been shown in L2 speakers speaking in a purely L2 context. However, I present some priming studies which have also looked at populations other than normal, monolingual adults, which have implications for L2 studies.

2.6.3 Priming of word order

The structures used in early priming studies (e.g., Bock, 1986, 1989; Bock & Loebell, 1990; Bock, Loebell & Morey, 1992) differed from each other in terms of phrasal constructions and hierarchical relations between them. For example, the DO and PO dative structures differ phrasally because the direct and indirect objects of the DO are both NPs, while the PO indirect object is within a prepositional phrase. As a consequence, the grammatical roles and hierarchical relations are also different between the two structures. However, priming has also been demonstrated when grammatical roles and hierarchical phrasal relations are kept constant across two alternative structures, but linear word order is varied. For example, Hartsuiker, Kolk and Huiskamp (1999) asked Dutch speakers to repeat prime sentences which used one of the two locative phrases shown in (i) and (ii) before describing target pictures. They also included a baseline using wh-questions as in (iii). In this locative alternation the functional relations and hierarchy of constituents is identical, with only the linear order of constituents differing.

- | | | |
|-------|---------------------------------------|-----------------------------------|
| (i) | <i>Een bal ligt onder de auto</i> | ‘A ball lies under the car’ |
| (ii) | <i>Onder de auto ligt een bal</i> | ‘Under the car lies a ball’ |
| (iii) | <i>Waar kun je die planten kopen?</i> | ‘Where can you buy those plants?’ |

Results showed significant priming of word order: participants were more likely to use a fronted locative like (ii) when the previous sentence had used that word order compared to another construction. However, an alternative account of this priming is in conceptual differences because the two structures also differ in terms of topic-comment structure (Hartsuiker & Kolk, 1998a). A conceptual explanation for word order priming was excluded in a subsequent study by Hartsuiker and Westerberg (2000). They investigated priming of the order of auxiliary verb and past participle in Dutch subordinate clauses, shown in (iv) and (v). In both written and spoken conditions, participants completed prime fragments which constrained either a completion ending in auxiliary-participle order or in participle-auxiliary order. In the target items, the fragments could be completed using either word order. Results showed a significant word order priming effect on both written and spoken production – participants tended to produce the same word order in the primes and targets.

(iv) *De man belde de politie omdat zijn portemonnee was gestolen*

‘The man called the police, because his wallet was stolen’

(v) *De man belde de politie omdat zijn portemonnee gestolen was*

‘The man called the police, because his wallet stolen was’

Not only are there no functional differences between these two alternatives, but there is also no conceptual difference. Indeed, auxiliary verbs have no intrinsic meaning apart from to mark tense, and act as function words, therefore cannot contribute to any conceptual priming by their position within the sentence. Hartsuiker and his colleagues interpreted the finding that word order can be independently primed as evidence for the existence of a stage in language production during which linear word order is computed, which is separate from and subsequent to the building of phrasal structure.

More recently, counter-evidence against this ‘two-stage’ model of constituent structure (i.e., hierarchical and linear word order being computed separately) was presented by Pickering, Branigan & McLean (2002) through a study of priming effects with shifted NP datives. A two-stage argument would claim that the intermediate representation for NP shifted structures would be identical to that of PO datives, sharing the same hierarchical relations, and only at the subsequent stage of linearization would the two structures become distinct in terms of word order. However, results showed that shifted structures did not prime the production of prepositional objects, but behaved like baseline primes. This finding is more compatible with a single-stage account in which shifted structures bear no special relationship with PO datives. Because they found no evidence for a separate stage of linearization, Pickering and colleagues concluded that both phrasal structure and linear word order are fixed in the same stage, without an intermediate representation between two processes.

2.6.4 Factors affecting syntactic priming

Lexical and semantic/thematic overlap between prime and target cannot explain syntactic priming, and this suggests an independent role for syntactic processing in language production. However, manipulation of these factors has been found to influence the priming effect and hence influence syntactic processing. I will now discuss some of these factors, which will have implications for the studies presented in subsequent chapters.

2.6.4.1 Lexical boost

Priming occurs in the absence of lexical overlap (e.g., Bock, 1989). However, repeating the head of a phrase across a prime and target increases the magnitude of priming (e.g., Branigan et al., 2000; Branigan et al., 2005; Cleland & Pickering, 2003; Pickering & Branigan, 1998). Pickering and Branigan (1998) studied the priming of dative structures using a written sentence-completion task. Participants were given a prime preamble to complete which would lead to either a PO (i) or DO (ii) completion. Following this, participants completed a target preamble which could finish with either a PO or DO construction, and this used either the same verb (iii) or a different verb (iv) as the prime.

- (i) The researcher sent the detailed results...
- (ii) The researcher sent the experienced surgeon...
- (iii) The man sent...
- (iv) The patient showed...

Results showed participants were significantly more likely to repeat the structure of the prime when the verb was the same than when it was different, a finding the authors termed the 'lexical boost' to priming. A similar effect has been demonstrated with the repetition of the noun when priming adjectival noun-phrase structures (Cleland & Pickering, 2003).

In the same set of studies Pickering and Branigan also looked at the effect of changing the tense, aspect or number of the repeated verb on same-verb priming. For example, comparing the priming effect of sentences using the verb form 'sent', 'send', 'was sending' or 'sends' to prime a target using the form 'sends'. Interestingly, they found that variation in morphology of the verb in prime and target did not affect the size of the priming effect.

Pickering and Branigan based their (1998) model of combinatorial nodes on these results (see section 2.4.2). Specifically, because priming is seen when the verb is different across prime and target, they concluded that combinatorial information is shared between verbs. They assume that the lexical boost reflects priming of links which exist between each verb and a combinatorial node. Priming of these links through co-activation of a

verb with a combinatorial node leads to an even greater likelihood that that structure will be reused with that verb. In addition, because varying the morphology of the repeated verb did not influence the priming effect observed, they concluded that lemma representations are not specified for tense, aspect or number information. Rather, the combinatorial information used in structural processing appears to be connected to a featurally unspecified form of the verb. At the same time, inflections and function words do not appear intrinsic to the combinatorial information, because the same syntactic structure is implicated in production regardless of the form of the verb in a particular instantiation. This is supported by Bock's (1989) finding that changing the preposition of a PO structure across prime and target did not affect syntactic priming effect produced. In addition, the finding that syntactic priming occurs when both content and functional morphemes vary across prime and target suggests priming does not stem from an episodic memory trace of the prime sentence, but rather is the persistence of a more abstract representation of the structure (Bock & Loebell, 1990).

2.6.4.2 Semantic overlap

A second factor influencing syntactic priming is semantic overlap between the head of a prime and target phrase. For example, Cleland and Pickering (2003) used a dialogue task to study priming of noun phrases with adjectival modifiers using a relative clause (*the sheep that's red*) as opposed to prenominal adjectival modification (*the red sheep*). In one experiment they varied whether the head noun in the prime (e.g., *sheep* for the above example) was the same as (i.e., *sheep*), semantically related to (e.g., *goat*), or semantically unrelated to (e.g., *knife*) the head noun in the target. The results produced significant priming of the relative-clause modifier structure in the absence of lexical overlap, but this priming was enhanced by the prime and target being semantically related (i.e., stronger priming from *goat* to *sheep* than from *knife* to *sheep*), and was strongest when the noun was repeated. This provides evidence for syntactic encoding being affected by semantic properties of the head noun. The authors explain it as follows. When someone hears *the red sheep* this activates the concept for *sheep*, and activation spreads from this to semantically associated concepts like *goat* which, in turn, leads to activation of the lemma for *goat*. In this way the *goat* lemma and the syntactic representations for a

pronominal adjective noun phrase are co-activated by the prime, as is a link between them. So, in the same way that the lexical boost is explained by residual activation in a link between a lemma and a combinatorial node, the semantic boost comes from residual activation in a link between an associated lemma and the combinatorial node.

Additional evidence that semantic overlap of nouns contributes to choice of syntactic structure comes from a study by Bock, Loebell & Morey (1992) which demonstrated that similarities in the meanings of words in parallel sentence positions or structural functions can affect which structure is chosen. The conceptual factor they studied was animacy and its connection to the assignment of subjecthood. They investigated syntactic priming of the transitive alternation, so half their primes were active and half were passives. In addition, they manipulated the animacy of the subject and object arguments, such that half the primes had animate subject arguments with inanimate object arguments, and the other half had inanimate subject argument with animate object arguments (see sentences (i)-(iv) below). All target descriptions involved an inanimate agent and animate patient.

- | | |
|---|------------------------------|
| (i) Five people carried the boat | (active, animate subject) |
| (ii) Five people were carried by the boat | (passive, animate subject) |
| (iii) The boat carried five people | (active, inanimate subject) |
| (iv) The boat was carried by five people | (passive, inanimate subject) |

Priming was implemented in a running recognition memory test in which participants saw a list of sentences (which they had to repeat) and pictures (which they had to describe) and were instructed to detect when individual items recurred. Results replicated previously-found structural priming, in that more actives were produced after active than passive primes. In addition, however, there was conceptual priming of grammatical role assignment. For example, more inanimate subject actives were produced after primes with an inanimate subject argument than primes with an animate subject argument, regardless of the syntactic form of the prime. This was taken as evidence for the impact conceptual factors can have on grammatical processing, and syntactic relation assignment, in addition to any structural priming effects.

2.6.4.3 Thematic role influence

A related finding to the semantic-boost to structural priming is that overlap in thematic roles across prime and target can also influence choice of syntactic structure. Bock and Loebell (1990) concluded that priming was insensitive to differences in thematic roles on the basis of finding that locatives primed passives equally as well as passive primes. However, more recent studies have demonstrated a priming effect of overlap in thematic roles on syntactic structure (Chang, Bock & Goldberg, 2003; Griffin & Weinstein-Tull, 2003; Hare and Goldberg, 2000). For example, Chang et al. used a sentence repetition technique, which employed rapid serial visual presentations (Potter & Lombardi, 1998), to explore whether overlap in thematic roles affected priming. In this paradigm, participants read a sentence word by word in silence. This is followed by a distractor task, and the participant must subsequently repeat the sentence aloud. The surface form of the sentence is not presumed to be stored in memory (especially without specific instruction to do so), so participants are seen to sometimes change the structure of the sentence when recalling it, often to reuse the grammatical structure of a different sentence from the trial preceding the experimental sentence. In this way, the preceding trial can be manipulated as a priming variable. Chang et al. looked at priming involving the *spray-load* locative alternation, as represented by sentences (i)-(iv) below:

- (i) The man sprayed wax on the car
- (ii) The man sprayed the car with wax

The alternation consists of varying the order of the theme (the thing that moves) and location (the place it is moved to) without varying the phrasal constructions [NP [V NP [P NP]]]. Chang et al. varied the thematic order of constituents in primes and targets. Results showed speakers tended to re-use the primed thematic role order of arguments in their target sentences, that is more location-theme order after a location-theme prime and vice versa, independent of a phrasal priming effect.

2.6.4.4 Knowledge of frequency and felicity of a structure

A final factor I discuss here that influences likelihood of producing a syntactic structure and its susceptibility to priming, is knowledge about constraints on when a structure should be used or not. In general, there is some evidence that relatively less frequent

(though not highly infrequent; see below) structures show stronger syntactic priming effects than more frequent alternatives within the same language (e.g., Bock, 1986; Ferreira, 2003a; Hartsuiker et al., 1999; Hartsuiker & Westenberg, 2000; Scheepers, 2003). For example, Hartsuiker et al. included a baseline in their study on locative word order (1999, see section 2.6.2), to obtain a measure of frequency of the target structures in the absence of priming. Compared to the baseline they found stronger priming of frontal locatives compared to canonical locatives, and explained this as priming having a larger impact on less frequent structures, which are less likely to be used otherwise. In addition, Ferreira (2003a,b) has suggested that it is the frequency of the *prime* structure and not the *target* which influences the magnitude of priming produced, with lower-frequency prime structures causing a bigger impact on the syntactic system and thus larger persistence effects. I return to this issue in Chapters 7 and 8.

However, lower-frequency structures do not always show stronger priming. If a structure is *strongly* dispreferred or pragmatically anomalous it may actually show *less* priming than a more common alternative. For example, Pickering et al. (2000) failed to find priming of the fairly-uncommon shifted-NP dative structure in English, and concluded that syntactic priming is not strong enough to overcome a strong dispreference for a particular structure (see Hartsuiker & Kolk, 1998a, for a similar finding for Dutch fronted datives).

The picture that emerges for the relationship between priming and frequency in L1 speakers may therefore be some form of inverse U-shaped curve. Very low-frequency or infelicitous structures are rarely produced and priming cannot facilitate a large increase in their use. Likewise, a very high-frequency structure is very likely to be used in the absence of a prime, so priming causes only a small increase in production. It is the structures that occur with moderate frequency that will be most susceptible to priming, and as the frequency of the structure increases this susceptibility will decrease. Interestingly, while L1 speakers resist production of certain structures, optionality in L2 speakers reflects the overuse or inappropriate-use of infelicitous structures, presumably as a result of incomplete mastery of these constraints (cf Sorace, 2003, 2004, 2005).

To my knowledge, no study to date has systematically set out to study how felicity conditions affect syntactic priming in L1 speakers, let alone applying this to L2

speakers. However, it might be inferred that if an L2 speaker treats a particular syntactic option as being appropriate, but an L1 speaker does not, then an L2 speaker will be more susceptible to priming of that structure than an L1 speaker, who will resist priming. This suggests that stronger priming might be found in L2 speakers compared to L1 speaker for structures which L1 speakers find infelicitous but L2 speakers find acceptable.

2.6.5 Priming in different populations

The majority of priming studies have focussed on adult L1 speakers. However, several studies have also looked at other populations of language users, which may have implications for L2 speakers. I discuss these studies in this section.

We have seen how syntactic priming offers a useful technique for studying syntactic production in a controlled experimental manner. Syntactic priming is a widespread and robust phenomenon in native speakers, found in a wide variety of situations and language, for a variety of different constructions. Priming suggests the existence of abstract representations for syntactic structures, which can be manipulated independent of other factors. However, to date there has been no demonstration of priming in non-native speakers in a purely L2 context. If priming can be found in L2 speakers, this would suggest that, to some extent, the same representations are involved in L2 and L1 speakers, and that they are processed by similar mechanisms.

Firstly, syntactic facilitation can be found in adult speakers who have been taught a new structure in their first language. Secondly, priming is seen in bilinguals speaking in their L2, when the prime is in their L1, and vice versa. Thirdly, priming is seen in another linguistically developing population: children acquiring an L1. Fourthly, priming has been found in Broca's aphasics, who constitute another group of speakers who have limitations in producing syntactic structures. I discuss each of these in turn.

2.6.5.1 Priming of newly acquired L1 constructions

Adult speakers appear capable of acquiring new, abstract structures in their native language and experimental evidence for this comes from comprehension priming for newly-acquired L1 structures in adults (Kaschak & Glenberg, 2004; Kaschak, 2006). Priming in comprehension is measured as an increase in the ease of processing a syntactic

construction after prior exposure to that structure. However, evidence for cross-modal priming from comprehension to production (e.g., Branigan et al., 2000; McLean et al., 2003) is interpreted as common syntactic representation underlying comprehension and production, so priming in comprehension also has implications for production. Kaschak and Glenberg trained adult English-speakers to comprehend a syntactic construction not present in their dialect of English (the “Needs” construction: *The meal needs cooked*, meaning ‘The meal needs *to be* cooked’). Participants read a list of sentences word by word and were told to press a button when they were sure they had understood the sentence. Reading times were taken as a measure of processing difficulty, with longer reaction times suggesting more trouble with parsing. Kaschak and Glenberg found that difficulty in processing sentences using the Needs construction decreased with exposure (as reflected by a decrease in reading times for the critical region). This facilitation of processing with exposure was found even when the new structure was presented with a different verb (*want*); this suggests an abstract form of the new structure has been acquired that can be applied to verbs other than the one with which the structure was learned.

In the case of L2 acquirers they must in addition learn to map the new structure(s) onto new vocabulary and inflectional morphology and phonology. However, Kaschak and Glenberg’s study does provide evidence that the adult cognitive system is capable of acquiring and processing new structures in an abstract form which can then be applied to new contexts.

2.6.5.2 Cross-linguistic priming in bilinguals

Syntactic priming has also been found in several studies on adult balanced bilinguals, where a prime is in one language and a target in another (Hartsuiker et al., 2004; Loebell & Bock, 2003; Meijer & Fox Tree, 2003; Schoonbaert et al., 2004).

Hartsuiker et al. (2004) found cross-linguistic priming in proficient bilingual Spanish-English speakers using a confederate-scripted dialogue game. Participants heard a prime in Spanish from a native-speaker interlocutor which used either an active, passive, object-verb-subject (OVS), or intransitive sentence structure, as exhibited in sentences (i)-(iv) respectively:

- | | | |
|-------|--|--|
| (i) | <i>El taxi persigue el camión</i> | 'The taxi chases the truck' |
| (ii) | <i>El camión es perseguido por el taxi</i> | 'The truck is chased by the taxi' |
| (iii) | <i>El camión lo persigue un taxi</i> | 'The truck (chasee) it chases a taxi (chaser)' |
| (iv) | <i>El taxi acelera</i> | 'The taxi accelerates' |

Participants then described other pictures in English, which could themselves be described using an active or passive construction. Results showed participants were more likely to produce an English passive after hearing a Spanish passive prime than an active or intransitive prime. Hartsuiker and colleagues interpreted this as evidence that syntactic form representations can be shared between languages, so combinatorial nodes are shared across all lemmas that can be used with that construction, regardless of language. There was also a numerical tendency for speakers to produce more passives after an OVS prime than an active or intransitive, although this did not reach significance. This suggests some underlying similarity between passives and OVS, likely based on the order of thematic roles being the same across the structures. Schoonbaert et al. (2004) extended this finding by showing a lexical boost to priming when the prime and target are in different languages but use verbs which are translation equivalents of each other. This offers additional evidence for lemmas in different languages being linked to the same non-language-specific combinatorial information.

Loebell and Bock (2003) found a similar result with dative structures in fluent German-English bilinguals. They used a similar task to Bock's original study (1986), in which participants heard and immediately repeated prime sentences before describing other pictures. Cross-linguistic priming was found both from the participants' L1 to their L2 and from their L2 to L1, although priming was stronger from the L1 to the L2. They did not find priming of transitive structures in either direction however, which they explained as the result of the passive having different surface structures in German and English. Loebell and Bock concluded that procedures for building sentence structures will be shared across languages if they are sufficiently syntactically similar. Therefore, where the procedures are shared, using a structure in one language will also leave it more accessible for use in the other language. All these studies show some evidence of priming in L2 speakers, because in each case either the prime or the target was in the learners' L2. However, it does not constitute full evidence for priming in an L2 monolingual context.

2.6.5.3 Priming in children (L1 learners)

Recent studies have demonstrated syntactic priming in a different developmental population: children acquiring an L1 (Branigan, McLean, & Jones, 2005; Huttenlocher, Vasilyeva & Shimpi, 2004; Savage, Lieven, Theakston & Tomasello, 2003; Thatcher, 2005). Savage and colleagues demonstrated priming in 3, 4 and 6 year olds using either active or passive transitive sentences as primes. The task involved the experimenter showing a child a picture and describing it with a prime sentence four times. A target picture was then presented and the experimenter asked the child 'What's happening?' to evoke a response. In a high lexical overlap condition the prime used some grammatical morphemes and pronouns that could be re-used by the child in her unrelated target utterance (*The digger pushed the bricks* or *The bricks got pushed by the digger*). In a low lexical overlap condition the prime used only pronoun arguments (*It is pushing it* or *It got pushed by it*), offering little opportunity for re-use of lexical items across prime and target. Results showed that in the high lexical overlap condition significant priming occurred for both actives and passives at all age groups. However, in the low lexical overlap condition, reliable priming was found only in the 6 year olds and not in the younger age groups. Savage et al. concluded that the cognitive representations of syntactic structures possessed by children at the age of 3 or 4 are still to some extent associated with specific lexical items (cf. Tomasello, 2000).

Huttenlocher et al. (2004) also looked at priming of verb-phrase structure, this time in 4 and 5 year old children and including both transitive and dative constructions. They used a method in which the children heard or repeated a prime sentence from the experimenter, and then saw a new picture to describe. The results showed a reliable priming effect for both transitive and dative structures, despite the absence of lexical overlap, so this suggested that children have abstract syntactic representations at the age of 4.

Branigan et al. (2005) studied use of noun phrases in children aged 3 and 4, looking for a syntactic priming effect and a lexical boost. The aim was to investigate whether these children had abstract syntactic representations for nouns and adjectives, but with links to specific lexical items, as has been suggested for adult speakers (Cleland &

Pickering, 2003). They used a dialogue game between the child participants and a confederate of the experimenter, the latter following a script of prime sentences. The syntactic structure of the prime was varied, as was whether the prime and target used the same or a different noun. The results showed a very strong priming effect in the children and a lexical boost: when the noun was the same in prime and target, children repeated the prime structure 70% of the time, when it was different this reduced to 52%. Similar results were found by Thatcher (2005), who compared child and adult priming directly in the same task. Thatcher found priming of relative-clause structures in children to be significantly larger than that in the adult group (31% vs. 7%, compared to baseline). Indeed, the adults showed only a slight priming effect (significant by items only), and Thatcher proposed this could be explained by the adults finding the relative clause structure (e.g., *the bag that's blue*) relatively marked and unnatural, therefore resisting using it. This supports the discussion in section 2.6.3.4, that dispreferred structures are difficult to prime in adults, but it appears they can be strongly primed in L1 language learners.

One of the issues to be addressed in this thesis is the extent to which syntactic priming in L2 speakers might mirror the results found in children, and what implications this would have for how adults L2 speakers acquire syntactic constructions.

2.6.5.4 Priming in aphasics

Syntactic priming has also been demonstrated in Broca's aphasics. It can be argued that this group shows similarities to L2 speakers in that they have more difficulties in processing syntax than normal, native speakers. For this patient group a defining symptom is that their syntax is reduced in complexity, and they find it very difficult to produce certain syntactic structures. Hartsuiker and Kolk (1998b) looked at Broca patients' sentence production in three conditions: spontaneous speech, picture description without priming, and picture description following a prime sentence presented simultaneously on a computer screen and spoken by the experimenter. They found that aphasics could be primed to produce complex sentences which they did not produce in their spontaneous speech or picture descriptions (datives and passives). This priming appeared to be automatic, because instructions to strategically reuse the grammatical

form of the prime sentences only enhanced priming in normal controls and not the patients. This finding supports the idea that cognitive limitations on syntactic processing can be facilitated with priming. In addition, Hartsuiker and Kolk found syntactic priming effects for aphasics in situations in which normal controls showed no priming for example with transitives in active/passive alternations. Hartsuiker and Kolk (1998b) had previously failed to find priming of the passive construction in normal Dutch-speaking adults, but the Brocas did respond to passive priming. This appears relevant in looking at L2 learners of a language, who may also have processing limitations compared to monolingual speakers (e.g., Dussias, 2003; Kilborn, 1992) and so be unable to produce a correct structure, but may be helped by priming.

Similar to results of Thatcher in children (2005; described above), we see that speakers with limitations, either due to brain damage or developing language, appear susceptible to priming of structures that normal, native speakers would not be. These findings also highlight an advantage of priming over other elicitation techniques: priming facilitates the use of constructions which would be unlikely to be produced in normal speech, either due to processing limitations in a speaker or a strong preference for an alternative structure. Looking at L2 production of different constructions might be difficult in spontaneous speech because participants would not be guaranteed to use a particular structure. In contrast, the boost priming gives to processing maximizes the chances of observing the structures of interest, and therefore offers the opportunity to study when and why a particular structure is used.

2.6.6 Summary

In section 2.6 I have discussed in detail the experimental method to be used in this thesis in order to study sentence production. Syntactic priming is a well-established and pervasive phenomenon in which processing of a particular structure is facilitated by processing of the same structure in a previous sentence. Priming has been demonstrated both when the structures being primed differ in terms of phrasal hierarchy and when they differ in terms of linear word order. Because priming is found in the absence of overlap in lexical items, semantics, or thematic roles across prime and target, priming has been taken as evidence for language users possessing abstract syntactic representations for the

persisting structures. However, inclusion of such overlap can influence the basic priming effect. Priming can lead to use of a structure which might not otherwise be produced, either due to processing limitations or to a stronger preference for an alternative, but if a particular structure is strongly dispreferred it appears difficult to prime because speakers are resistant to using that option

I also described some of the different populations in which syntactic priming has been demonstrated. Adult speakers can be taught a new structure in their L1, and subsequently show priming effects for that structure, even transferring knowledge to new verbs. This shows that adults are capable of acquiring abstract syntactic structures in their native language and suggests that new structures could also be acquired in an L2. Priming has been found in L2 speakers, as demonstrated by cross-linguistic studies, and this is used to support models of bilingual speakers in which syntactic structures are, where appropriate, shared across two languages. However, in these experiments the prime and target were always in different languages. In contrast, the current thesis explores priming when both prime and target are in the L2. Priming has also been found in another developmental population: children acquiring an L1. Interestingly, these priming studies support that young children acquire syntactic structures in a lexically-specific manner, and do not possess abstract transferable structures until later developmental stages. I will address whether L2 speakers also acquire structures in this way. Finally, priming is found in aphasics for structures which they cannot produce spontaneously and this group can even be primed to produce structures that normal adults will not produce. Therefore, priming offers a technique for facilitating syntactic processing deficits, which may also be found in L2 speakers.

2.7 Overall Summary

The aim of this chapter was to introduce the background literature for the experiments I will present in the chapters that follow. The focus of the thesis is to provide psycholinguistic evidence for how L2 speakers produce syntactic structures in the target language, and how this might be similar to or differ from native speakers.

I began with a discussion of why language processing might be different in L1 and adult L2 learners of the same language, and considered what an L2 speaker must

acquire in order to produce syntactic structures in a native-like manner. I introduced the idea of L2 optionality, in which L2 speakers will treat two syntactic options as being equally appropriate for a particular context whereas native speakers will strongly prefer one alternative. I discussed in more detail one example of optionality which will be the focus of several studies in this thesis: lexico-semantic constraints on choice of word order in L1 and L2 Spanish.

I then moved on to discuss well-established psycholinguistic models of L1 language production, focussing on the level of grammatical processing and how constituent structures are formed. I discussed models adapting L1 psycholinguistic production models for L2 (or bilingual) speakers, and concluded that more data is needed to corroborate these models, in particular about how syntactic structures are produced in L2 speakers. There has been a recent surge in on-line studies of L2 processing, but these have tended to focus on comprehension, whereas the current study addresses production.

I finished this chapter by introducing an experimental technique for exploring sentence-level production in real-time: syntactic priming. I reviewed the priming experiments to date, including what factors influence priming and what populations have already shown priming. This technique will form the basis of the experiments in this thesis. The primary question is how priming effects might be similar or different across L1 and L2 speakers, and what implications this has for models of L2 production.

In the chapters which follow I present a series of experiments which examined sentence level processing in L1 and L2 speakers, providing evidence for similarities and differences in the way native and non-native speakers produce syntactic structures.

3 Syntactic Priming and Lexical Boost in L2 Speakers

3.1 Overview

In the previous chapter I outlined some models of monolingual language production based on psycholinguistic research. In considering the extent to which L1 and L2 syntactic processing will be similar, I highlighted that adult L2 speakers have particular difficulties when a choice must be made between two structures. In addition, I introduced the technique of syntactic priming as a method for investigating how syntactic structures are processed in sentence production.

In the current chapter I will compare L1 and L2 syntactic production in L1 and L2 speakers of Spanish using syntactic priming. As mentioned in Chapter 2, priming is taken as evidence that syntactic processing can be isolated from other levels of linguistic processing, and that adult L1 speakers of a language possess abstract syntactic representations for the persisting structures. If similar effects can be found in L2 speakers this would implicate similar architectures and mechanisms in non-native and native production.

I will begin by reviewing why both similarities and differences might be expected in L1 vs. L2 syntactic production, and how syntactic processing might change with L2 proficiency. I will then present Experiment 1, which used a dialogue task to study syntactic priming of active and passive structures in L1 speakers and two proficiency levels of L2 speakers of Spanish. Specifically, Experiment 1 examined whether the same pattern of effects would occur in both L1 and L2 production, and at different proficiencies.

3.2 Introduction

In Chapter 2 we saw that psycholinguistic models of L1 language production include a level of grammatical processing where individual lexical items are combined to form larger, syntactically-specified structures according to the grammatical rules of that language (e.g., Bock & Levelt, 1994; Garrett, 1980, 1988; Levelt, 1989). The syntactic information required to do this is assumed to be stored at the lemma level (Levelt et al., 1999; Roelofs, 1992, 1993), associated with the lexical items for which it is appropriate,

and this includes combinatorial information about possible phrasal structures (Pickering & Branigan, 1998). This combinatorial information is abstract, so use of a structure is not dependent on using particular words. However, there are also links between combinatorial information relating to a structure and the lemmas with which that structure can be used. When a particular structure is used with a particular lexical item, the activation of both the structure and the link between it and the lemma is increased, or strengthened.

As I have noted in Chapter 2, psycholinguistic models largely do not account for L2 production at the sentence level, and those that do lack experimental evidence to corroborate claims about L1 vs. L2 systems. So, to what extent might the syntactic representations and processes described for L1 language production be the same for L2 speakers, and how justified is an assumption that L2 and L1 syntactic systems will be similar?

Recent cross-linguistic studies suggest that syntactic representations are shared across the two languages in advanced bilinguals (e.g., Hartsuiker et al, 2004; Loebell & Bock, 2003). This was on the basis of finding that syntactic priming occurs across languages. For example, a Spanish-English bilingual hearing a passive structure in Spanish is subsequently more likely to produce a passive structure in English. This implies a shared representation of the passive at some non-language-specific level. However, these studies have looked at use of both languages in the same context (a 'bilingual mode', cf Grosjean, 1997, 1998) and it may be that processing in a purely L2 mode will have different effects on the availability of L2 syntactic structures. In addition, these studies looked at highly proficient bilinguals, often living in the country of the L2. But would the same effects be observed in less proficient learners, who have had less exposure to an L2 environment?

3.3 Syntactic structure processing in L1 and L2 speakers: similarities and differences?

There are strong reasons to believe that the L2 syntactic processing system will be grossly similar to the L1 system. Given that an L2 is acquired on top of a pre-existing fully developed lexico-semantic system, we would expect to find gross similarities in

syntactic processing in L1 and L2 speakers. Indeed, most researchers working in bilingualism assume that speakers with more than one language use the same message-level processes for all languages (e.g., Costa, Miozzo & Caramazza, 1999; Fox, 1996; Kroll & Stewart, 1994; Schwanenflugel & Ray, 1986). In addition, although each language will have its own morphophonological characteristics, there is the same requirement for mapping thematic roles from semantic level onto syntactic structure. If the representations and procedures which carry this out in an L1 are already in place, why not apply the same or similar procedures to all languages?

However, there are also reasons to believe there will be differences in L1 and L2 syntactic procedures. As discussed in Chapter 2, native and non-native syntactic knowledge is observed to sometimes differ even at high proficiencies (e.g., Coppieters, 1986; Johnson & Newport, 1989; Lardiere, 1998; Sorace, 2000, 2003, 2005). Specifically, even at advanced levels of proficiency adult L2 speakers may continue to use a particular syntactic option that a native speaker would consider infelicitous (e.g., Beck, 1997; Oshita, 2001; Papp, 2001; Sorace, 2000, 2003, 2005). Similarly, several on-line studies of L2 comprehension have produced differences in L1 and L2 speakers' syntactic strategies for processing (see Clahsen & Felser, 2006, for a review). L2 speakers often appear to rely more on semantic than syntactic information in comprehension, while adult L1 speakers are seen to apply syntactic parsing strategies which are language-specific (e.g., Clahsen & Felser, 2006).

3.4 Priming task

The preceding section outlined that there is a need for experimental work on L2 speakers, if we are to develop a psycholinguistic model of multilingual speech production. I now present a study which looked for syntactic priming of active vs. passive structures in L1 Spanish speakers and L1 English-L2 Spanish speakers at two levels of proficiency (intermediate and advanced). As discussed in Chapter 2, priming is the phenomenon whereby people have a tendency to repeat the syntactic structure of an immediately preceding, unrelated sentence. This tendency occurs in the absence of lexical overlap across sentence, but is boosted by repetition of the head across prime and target (e.g., Branigan, et al., 2000; Branigan, Pickering & McClean, 2005; Pickering & Branigan,

1998). These effects are well established in L1 speakers, and have implications for syntactic representations and how they are processed in production, so they offer an opportunity to compare these features across L1 and L2 speakers.

Examples of Spanish active and passive sentences (from Prat-Sala & Branigan, 2000) are given in (i) and (ii), followed by their English translations. The sentence in (iii) shows another structural option in Spanish, OVS order. This structure is in the active voice, but uses the same order of thematic roles as in a passive (patient-verb-agent).

- (i) *El tren atropelló a la mujer*
'The train ran over the woman'
- (ii) *La mujer fue atropellada por el tren*
'The woman was run over by the train'
- (iii) *La mujer, la atropelló el tren*
'The woman, her-OBJ ran over the train-SUBJ

The active-passive prime alternation was chosen for several reasons. First, both actives and passives exist in both English and Spanish with fairly similar superficial structure. I suspected this would enhance the likelihood of finding a priming effect. Second, the cross-linguistic priming found by Hartsuiker et al. (2004) used actives and passives in English-Spanish bilingual speakers. In addition, other production studies have found both active and passives in Spanish are produced to describe similar materials to those used in the current experiment (Prat-Sala, 1997; Prat-Sala & Branigan, 2000). Thus, there was a precedent for looking at these structures in Spanish in the current study.

The task used was based on the confederate-scripted dialogue technique, first used by Branigan et al. (2000). Pairs of participants took turns to describe pictures to one other and match these to their own pictures. One of the participants, unbeknown to the other 'naïve'¹² participant was a confederate of the experimenters, and followed a script which pre-specified the form of each description in order to provide the experimental primes. As had previously been found in monologue contexts, Branigan et al. observed significant priming of PO and DO dative forms and a lexical boost to priming within this dialogue situation (2000). The syntactic forms of the naïve participants' descriptions were

¹² A more appropriate term may be 'experimental participant', however I follow Branigan et al.'s (2000) original use of the label naïve for the purposes of this thesis.

influenced by the syntactic forms of the confederate's descriptions, and this influence was greater when the verbs were repeated across primes and targets. Interestingly, the magnitude of the effects in the dialogue task was considerably larger than priming effects found with dative constructions in previous studies (e.g., Bock, 1986; Bock & Loebell, 1990).

Experiment 1 used this dialogue technique, employing native speakers of Spanish to act as confederates. This provided a semi-naturalistic setting in which to observe language production. In addition, because comparatively strong priming effects are obtained using this task, this was chosen to maximise the likelihood of finding priming using a previously untested population (L2 speakers).

3.5 Predictions for the current study

If a syntactic priming effect can be established in L2 speakers this would be evidence for learners possessing abstract syntactic knowledge about the constructions which persist, as has been argued for in L1 speakers. Because syntactic aspects of L1 production models have, in part, been based on results from syntactic priming studies (e.g., Bock & Levelt, 1994; Pickering & Branigan, 1998), similar findings in L2 speakers would also support that these models can be extended to account for L2 production. Any differences in the behaviour of L2 speakers at different proficiency levels would also offer data on how the syntactic production changes in the course of L2 development. I now discuss effects which might differ across L1 and L2 speakers at different proficiencies: magnitude of priming, and nature of lexical boost.

3.5.1 Magnitude of priming

There may be important differences between the way L1 and L2 speakers acquire and process syntactic structures, and this may result in different patterns of production in adult native and non-native speakers. Firstly, L2 speakers have less experience with structures in the target language compared to L1 speakers. Secondly, L2 speakers are known to have problems in acquiring constraints associated with use of structures in the new language. Thirdly, there may be influences on L2 syntactic processing from the L2 speaker's L1. Any combination of these factors may influence an L2 speakers'

production of syntactic structures causing differences in the effects seen in L1 and L2 speakers. I now consider each factor in turn.

In terms of experience, L2 speakers have had less exposure to the new language than L1 speakers, and so presumably have encountered L2 structures less frequently. In addition, the more proficient an L2 speaker is, the more frequent L2 structures will become for them. Under an activation account of priming (e.g., Branigan et al., 2000; Cleland & Pickering, 2003; Pickering & Branigan, 1998), syntactic representations that are lower frequency will have a lower resting level of activation and benefit disproportionately from residual activation arising through prior processing. Lower frequency structures should therefore display stronger priming effects than syntactic representations with a higher resting level of activation. Models of syntactic priming that are based on strengthening of message-to-syntax mappings (e.g., Bock & Griffin, 2000; Chang et al., 2000) also predict stronger priming for structures that have been less frequently encountered. Evidence for this prediction comes from two sources. First, there is some evidence that in L1 speakers relatively less frequent (though not highly infrequent; see below) structures show stronger syntactic priming effects than more frequent alternatives within the same language (e.g., Bock, 1986; Bock & Griffin, 2000; Hartsuiker et al., 1999; Hartsuiker & Westenberg, 2000; Scheepers, 2003). Second, studies of other populations that might be considered to be of restricted competence and/or performance in language processing show a similar propensity towards particularly strong priming (e.g., Branigan et al. 2005; Hartsuiker and Kolk, 1998b; Thatcher, 2005).

If the syntactic structures in an L2 linguistic system are all at a lower frequency than in an L1 system, L2 speakers might therefore be more susceptible to priming than L1 speakers. In support of this prediction, priming in children, who would also possess 'lower frequency' syntactic structures under this argument, is significantly stronger than in adult speakers of the same language (Thatcher, 2005). Furthermore, assuming that proficiency in a language is linked to experience in that language, we would expect a link

between proficiency and susceptibility to priming, with lower-proficiency bilinguals displaying stronger priming than higher-proficiency bilinguals.¹³

A second factor which may influence the magnitude of priming in L2 speakers is they have reported difficulty in acquiring the constraints associated with using particular syntactic structures in the new language. As discussed in Chapter 2, this is an example of what is termed optionality: L2 speakers treat a syntactic option in the new language as being appropriate for the context, despite native speakers of that language having marked preferences for an alternative (e.g., Sorace, 2003, 2004, 2005). This will influence the likelihood of L2 speakers producing a particular structure. With respect to the current experiment, although the passive is a grammatical structure in Spanish, it is relatively infrequent and marked in spoken L1 Spanish (e.g., Prat Sala, 1999; Stewart, 1999). For example, in a baseline condition using similar materials to the current study, Prat-Sala found native speakers of Spanish produced 11% of transitive descriptions using the *ser* passive, in comparison with English speakers who produced 35% passive descriptions for the same pictures. In contrast, L2 speakers of Spanish may tend to produce passives more frequently. This could be explained by incomplete mastery of the discourse conditions governing its felicitous use (Butt & Benjamin, 1994; Sorace, 2003, 2004, 2005; Sorace & Robertson, 1999), e.g., passives are more frequent when the discourse focuses the patient of the action (Prat-Sala & Branigan, 2000). Such a tendency might be enhanced by transference of preferences from their L1. For example, English native speakers might tend to produce a higher proportion of passives when speaking Spanish than L1 Spanish speakers because the passive is more common in English than it is in Spanish (that is, there are fewer felicity conditions upon its use).

¹³ With respect to this prediction, it is important to note that the demonstrated effects of frequency upon priming might reflect the relative frequencies of the alternatives between which a choice is being made, rather than their absolute frequencies. Assuming that the input to L2 speakers mirrors that to L1 speakers, then the relative frequencies of the relevant alternatives will be the same for L1 and for L2 speakers (irrespective of proficiency). In that case, L1 and L2 speakers of all proficiencies would display comparable priming. This prediction is complicated, however, because explicit instruction to L2 speakers may lead to the inflated frequency of a less frequent structure relative to a more common structure in the L2. In addition, each L2 speaker will experience a slightly different input during learning, making it difficult to assess the exact experience learners have had with specific syntactic structures. However, in the course of the thesis I dismiss the suggestion that L2 speakers should be more susceptible to priming *per se*, and therefore I will not explore this argument further.

With respect to how this will effect syntactic priming, we saw in Chapter 2 that highly dispreferred structures may show *less* priming than a more common alternative in adult L1 speakers (Hartsuiker & Kolk, 1998a,b; Pickering, et al., 2000; Thatcher, 2005). Syntactic priming is presumed not strong enough to overcome a strong dispreference for a particular structure. Indeed, the finding by Thatcher (2005) that children show stronger priming than adults in an L1 can be explained by the primed structure (adjectival relative-clause) being relatively dispreferred for adult speakers but children have not yet acquired this constraint. Hartsuiker and Kolk (1998) also failed to find priming of the fronted dative structure in normal adult speakers of Dutch (Hartsuiker and Kolk, 1998a). In terms of the current study, L1 speakers of Spanish might show less priming for the passive structure because it is dispreferred and they therefore resist its usage. In contrast, L2 speakers of Spanish may not be sensitive to this dispreference and so willing to use the passive, and therefore they may show stronger priming. This argument would not predict that L2 speakers will always show stronger priming than L1 speakers, but only in contexts where one of the primed alternatives is unacceptable to the native speakers.

A third and related factor is that the existence or absence of structural representations in a learner's L1 might also affect L2 processing; I will return to this point in detail in Chapter 5. Thus, there are various factors which may influence syntactic production in L2 speakers and cause it to be different to that in L1 speakers.

3.5.2 Lexical boost effect

As well as examining the magnitude of priming across L1 and L2 speakers, this experiment was designed to explore any lexical boost effect in L2 priming. As mentioned above, the lexical boost is well established in adult L1 speakers, and is informative about how combinatorial information might be linked to specific lexical items. This effect has been interpreted as reflecting residual activation of a link between lemmas and shared combinatorial information (Pickering & Branigan, 1998). If L2 speakers also show increased priming when there is lexical repetition between prime and target, this would be further evidence for the similarity in the syntactic architecture of L1 and L2 speakers.

I now consider two possible approaches to how the links between specific lemmas and combinatorial information develop in L2 speakers. The first approach draws analogy

between L2 acquisition and L1 acquisition by children. Indeed, there are several similarities in the development of syntax in children learning an L1 and adults acquiring an L2 (Hawkins, 2001), leading us to suppose there are similar processes involved. However, there are also key differences in the two types of acquisition, for example that children come to the task with no linguistic system in place, and because ultimate attainment may be argued to be different in L1 and L2 acquirers (e.g., Long, 1990). A second approach assumes that knowledge from the learner's existing linguistic system (their L1) can be transferred to the L2. I now consider both approaches in turn, along with the implications they have for the priming effect and lexical boost to priming in L2 speakers.

One influential approach to L1 acquisition has suggested that during early language development a child acquires particular syntactic constructions in an item-specific manner, associating them with particular lexical items (Tomasello, 1992; Tomasello & Brooks, 1998; see Tomasello, 2000, for a review). Only later is more abstract knowledge of syntactic structures acquired (analogous to the independent combinatorial nodes in Pickering & Branigan, 1998)¹⁴. This model has been supported by research on syntactic priming effects in young children, which suggests that syntactic priming in younger children is only found when there is high lexical overlap between a prime and target (Savage et al., 2003). This suggests that cognitive representations of some syntactic structures may still to some extent associated with specific lexical items (but see Branigan, McLean & Jones, 2005, and Huttenlocher, et al, 2004).

If L2 acquisition proceeds analogously to L1 acquisition, then similar verb-specific processing would be expected in early L2 speakers as in children. Initially, the links between combinatorial information and specific lexical items in L2 speakers would

¹⁴ The alternative, nativist approach argues that children do not have to learn or acquire abstract syntactic structure because they are already present within an innate language faculty and the child only needs to learn how to use this competence in performance (e.g., Chomsky, 1981; Pinker 1994). Limited syntax in children is therefore attributed to processing problems, such as limited working memory. This approach is based on observations that, for example, early child language mostly conforms with adult grammatical constraints. In addition, proponents of this view claim children demonstrate syntactic knowledge that could not be determined from the input (poverty of the stimulus argument), and children may produce grammatically correct utterances which they could have not heard from an adult (e.g., *allgone sticky*, Braine, 1971, cited in Tomasello, 2000). However, proponents of the alternative, usage-based view argue there is not enough experimental evidence for the nativist claim and there is evidence against the claim. Further discussion of this debate is beyond the scope of the current thesis.

develop without a more independent representation of the structure being available. On this basis I would predict a large effect of proficiency on the boost to priming conferred by lexical repetition, as in L1 development. In that case syntactic priming in lower-proficiency L2 learners would be dependent on lexical overlap between prime and target, with considerably less, or no, syntactic priming in the absence of lexical repetition. In more proficient L2 speakers, combinatorial knowledge would become generalized across all appropriate lemmas; this predicts strong syntactic priming even in the absence of lexical overlap, and a smaller lexical boost (as in the older children in Savage et al., 2003), though the boost would still be greater than for L1 speakers. Hence this account predicts an inverse correlation between proficiency and the lexical boost.

There are, however, also key differences between L1 and L2 acquisition. L2 adult speakers already possess a fully-developed abstract syntactic system in their L1, including knowledge of syntactic categories and how to combine these into syntactic structures. In addition if, as proposed by Hartsuiker et al. (2004), syntactic knowledge can be shared across languages in bilinguals where appropriate, this sharing may well happen early on in the acquisition process. On this basis the abstract structures are in place from the early stages of acquisition, so priming in the absence of lexical repetition would be expected even in early development.

Another reason that L2 speakers might acquire abstract syntactic knowledge early on is that the nature of L2 acquisition often involves students' attention being explicitly drawn to syntactic elements of language, either through teaching (both in textbooks and classrooms) about abstract syntactic rules, or through the student themselves noticing patterns in the language. However, the recent consensus seems to be that explicit instruction has limited effects on the course of L2 syntactic development (e.g., Doughty, 2003; Norris and Ortega, 2000). I therefore will not discuss this idea further.

Finally, in Chapter 2 I discussed evidence from comprehension priming that newly-acquired L1 structures in adults are not verb-specific (Kaschak & Glenberg, 2004). Participants have little difficulty in comprehending a newly-acquired construction in a new context even when it involves a verb not used in the training phase. This suggests that the structural knowledge acquired is abstract, applying to a category of verbs, and not verb-specific. If L2 learners possess abstract syntactic knowledge based on category

membership from the early stages of acquisition (as a result of combinatorial information transferred from their L1, or explicit L2 instruction), then syntactic knowledge will not be dependent on links to specific lexical items even in early learners. This account therefore predicts strong syntactic priming even at low proficiencies and even in the absence of lexical repetition. Most critically, and in contrast to the account which draws an analogy between L1 and L2 acquisition, this account predicts no correlation between proficiency and the lexical boost.

3.5.3 Summary

In sum, there is a need for more experimental investigation of sentence level production in L2 speakers and syntactic priming offers a useful technique for exploring syntactic production, but has not previously been demonstrated in a purely L2 context. I now present the first of a series of experiments designed to determine to what extent L1 and L2 syntactic production is similar, and thus to what extent models of L1 production can be applied to L2 speakers.

A primary motivation for this experiment was to establish a basic priming effect in L2 speakers. If speakers possess internalized abstract representations of syntactic constructions in a language that they have acquired after childhood, then we would expect to find syntactic priming effects in L2 speakers, just as in L1 speakers. The comparative magnitude of priming in L1 and L2 speakers may be dependent on a variety of factors, including relative exposure to the target language and the acceptability of the primed structure for native speakers of the language.

A second issue is whether L2 speakers will demonstrate a lexical boost to priming, which is informative about how combinatorial information is attached to specific lexical items. An analogy with child L1 learners would predict that syntactic knowledge in L2 speakers may initially be verb-specific and only become abstract over time. A large lexical boost would be expected in lower-proficiency L2 speakers, which would reduce with increased proficiency. Under an alternative approach, abstract syntactic knowledge, and so priming in the absence of lexical overlap, may be present in adult L2 speakers from early stages of acquisition and would not be related to proficiency.

3.6 Experiment 1

3.6.1 Participants

36 participants were paid £5 to take part in the experiment. See Table 3-1 for details. I will refer to these participants as naïve participants to differentiate them from the confederate participant in the dialogue. All participants were tested in Edinburgh.

Participant Group	Age	Time spent in L2-speaking country (months)	Score on Spanish Cloze test (out of 50)
L1 Spanish	26 (2.3)	3.9 (6.8)	50 (1.0)
Advanced L2 Spanish	28 (8.5)	16 (19)	43 (4.8)
Intermediate L2 Spanish	23 (5.8)	5.6 (4.2)	29 (6.1)

Table 3-1: Details for the participants in Experiment 1, showing the mean age, time spent in an L2-speaking country (for the L1 Spanish group this meant ‘English-speaking country’, for the L2 Spanish groups this meant ‘Spanish-speaking country’), and score on the Cloze test. The standard deviation is shown in brackets.

12 naïve participants were L1 speakers of Castilian Spanish staying in Edinburgh. These speakers were recruited through advertisements in Spanish, specifying that Spanish speakers were needed with little or no experience with English. In addition, the experimenter spoke to each participant before the study and if they felt the participant’s level of English was higher than an intermediate level they were not invited to take part in the study.

The other 24 naïve participants were native speakers of English who started learning Spanish as a second language after the age of 13. Their proficiency in Spanish was evaluated using a 50-question Cloze test designed to evaluate knowledge of both grammar and vocabulary. For each question, participants saw a sentence with a gap at some point and were required to choose from 4 options the word or phrase which fitted best in the gap. The test was taken from a version of the DELEs’ (Diplomas of Spanish as a Foreign Language) assessment papers. The test has been used in many previous studies on L2 Spanish (e.g., Duffield & White, 1999; Montrul & Slabakova 2002, 2003) and has

proven successful in determining proficiency levels for L2 learners and in predicting linguistic performance in this population.

The total score for each participant was out of 50. Following established usage (e.g., Montrul & Slabakova, 2003), naïve participants scoring between 25 and 36 were classified as Intermediate and those between 37 and 50 as Advanced. 12 naïve participants were classified as having an Intermediate proficiency level of Spanish, scoring an average of 29 on this test (range 19-35). 12 naïve participants were classified as having an Advanced level of Spanish, scoring an average of 43 on this test (range 37-48).¹⁵ All L2 participants also confirmed after the experiment that they had encountered the Spanish *ser* passive before the study.

The confederates were 3 female students, 2 from mainland Spain and 1 from Mallorca, average age 26. All spoke Castilian Spanish as their L1 and were paid for their help in the study.

3.6.2 Materials

The experimental items were based on descriptions of pictures depicting transitive actions involving two inanimate objects. Only inanimate entities were depicted, for a number of reasons. One reason was to control for tendencies people have to put animate agents early on in sentences. Both agency and animacy are strongly associated with subject position in a sentence (e.g., McDonald, Bock & Kelly, 1993; Prat-Sala & Branigan, 2000) which would promote an active sentence structure. A second reason was that in Spanish the preposition *a* (meaning ‘to’ or ‘at’) is required before animate but not inanimate direct objects (see sentences (i) and (ii) respectively).

- | | |
|---|---------------------------------------|
| (i) <i>El médico golpeó a la camarera</i> | ‘The doctor hit PREP-to the waitress’ |
| (ii) <i>El medico golpeó la mesa</i> | ‘The doctor hit the table’ |
| (iii) <i>La camarera fue golpeada por el medico</i> | ‘The waitress was hit by the doctor’ |

¹⁵ I did not use very low-proficiency speakers of L2 Spanish because I required participants to have a certain level of vocabulary knowledge in order to understand the materials and therefore be able to perform the task correctly. In addition, I was interested in establishing an initial priming effect and so wanted to ensure that all the L2 participants had enough experience with active and passive structures to have some form of representation for these structures in the L2.

Including a preposition in actives would make the phrase-level structure the same for both actives (i) and passives (iii) (NP [VP PP]) and if syntactic priming is assumed to be phrasal in nature (e.g., Bock, 1989; Bock & Loebell, 1990) this would reduce the likelihood of a difference in active and passive priming.

Finally, apart from the psycholinguistic reasons for using the inanimate entities, the inanimate objects chosen for the study had high-frequency names and constituted vocabulary with which the intermediate L2 speakers would be familiar. In contrast, it proved difficult to find enough animate entities (e.g., professions) which could be depicted in picture form and which the Intermediate L2 speakers would be familiar with in Spanish.

I constructed two sets of 24 cards depicting transitive actions involving two inanimate objects. The relevant verb was printed in the infinitive form beneath the picture. One set of cards depicted the pictures that the participant would match to the confederate's prime description (Matching cards) and the other set depicted pictures for which the naïve participant would produce target descriptions (Description cards). 24 objects appeared across the 24 Description cards, each object appearing on two different cards, once as the agent of an action and once as the patient. In half the pictures the agent appeared on the left-hand side of the card and in the other half the agent appeared on the right-hand side. The pictures on the 24 Matching cards were prepared in the same way but used a different set of 24 objects.

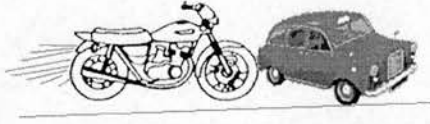
I pre-tested all these objects to ensure they were both easily recognisable and had a name that the Intermediate participants would know in Spanish. This was done by asking two early Spanish learners to name the objects (only objects which both speakers could name were included), and also by checking with a teacher of Spanish at the University of Edinburgh that this vocabulary was at an appropriate level for Intermediate L2 speakers.

On each of the Description cards was printed one of six Spanish transitive verbs, each verb appearing on four cards. The verbs chosen for the experiment were all transitive, both in Spanish and in their translation-equivalent in English. These verbs were chosen because of their reversibility, i.e., they could be used in both active and passive form, and because they could be easily depicted and recognised in picture form.

They were also relatively high frequency words with which I expected the Intermediate learners to be familiar. The verbs were: *destruir* ('to destroy'), *empujar* ('to push'), *ocultar* ('to hide'), *quemar* ('to burn'), *romper* ('to break') and *tocar* ('to touch'). On each of the Matching cards was printed one of twelve transitive verbs, each verb appearing on two cards. Six of these verbs were the same as the verbs on the Description cards, the other six verbs were: *cortar* ('to cut'), *golpear* ('to hit'), *llevar* ('to carry'), *mojar* ('to wet'), *partir* ('to part in two') and *perseguir* ('to chase').

Each Description card was paired with two of the Matching cards (each Matching card was paired twice, so it was attached to two Description cards). In a "same-verb" pairing, the Description and Matching cards had the same verb printed on them. In a "different-verb" pairing, the Description cards were paired with Matching cards depicting a verb that didn't appear in the Description set. In the different-verb condition care was taken to not pair up two verbs with similar meanings (e.g., *partir* with *destruir* or *romper*, or *golpear* with *tocar*) to avoid any semantic effects on syntactic priming (Cleland & Pickering, 2003).

An active and a passive prime sentence was generated for both of the Matching cards paired to each Description. Half the prime sentences matched the Matching cards and half were different in some way. For a quarter of the Matching cards, the corresponding sentences used a different object as the agent than that depicted in the picture, and for another quarter the sentences used a different object as the patient than that depicted (hence eliciting a 'no' matching response). There were four different prime sentences for each Description card – an active prime using the same verb, a passive prime using the same verb, an active prime using a different verb, and a passive using a different verb. Each experimental item therefore consisted in a Matching card and its associated 4 primes paired with the Description card. For example, the Description card in figure 3-2 was paired with the sentences (i) to (iv), each representing a different prime condition, shown in brackets after each sentence (the English translation is seen below each sentence):



EMPUJAR

Figure 3-2: An example of a target Description picture in Experiment 1. The action depicted is ‘to push’ (*empujar*), with a motorbike as the agent and a taxi as the patient.

- | | |
|---|---------------------------|
| (i) <i>El tanque empuja la guitarra</i> | (active, same verb) |
| ‘The tank pushes the guitar’ | |
| (ii) <i>La guitarra es empujada por el tanque</i> | (passive, same verb) |
| ‘The guitar is pushed by the tank’ | |
| (iii) <i>El helicóptero lleva la maleta</i> | (active, different verb) |
| ‘The helicopter carries the suitcase’ | |
| (iv) <i>La maleta es llevada por el helicóptero</i> | (passive, different verb) |
| ‘The suitcase is carried by the helicopter’ | |

The experimental items were placed into four lists, each comprising of six items from each condition such that only one version of each Description card-prime sentence pairing appeared in each list. These four lists were used to construct scripts which the confederate then used in the dialogue with each naïve participant.

48 filler Description pictures and 48 filler Matching pictures were also constructed, the latter being paired to 48 sentences describing the pictures. The filler pictures depicted a single inanimate object with an adjective written in the masculine form beneath the object. Participants were required to describe this object using the adjective provided. Adjectives were used in filler items instead of intransitive verbs (as used in previous transitive priming studies) because intransitives could be construed as activating the active voice, and this could have an effect on the active/passive manipulation. Hartsuiker et al. (2004) found no difference in the amount of passives used

following an intransitive baseline prime compared to following an active prime. One explanation for this asymmetrical priming effect was that an intransitive actually has active morphology (using the active voice) so can possibly act to prime actives compared to passives.

For the sentences corresponding to half the Matching filler pictures, the object in the sentence was different to that depicted (hence eliciting a *no* matching response). Individually randomized lists were prepared containing the 24 experimental items (24 sentences and corresponding Matching cards to be matched, and 24 Description cards to be described by the naïve participant) and the 96 fillers (48 fillers to be matched and 48 fillers to be described by the naïve participant) with the stipulation that at least two fillers intervened between any two experimental items.

3.6.3 Procedure

See figure 3-3 for a diagram of the experimental set-up. To ensure that all participants understood the task clearly, instructions were given to each participant in their native language (Spanish for the L1 speakers, English for the L2 speakers). Participants were initially given written instructions to read through, and the experimenter then went through the instructions checking the task was fully understood.

Before starting the experiment all L2 speakers of Spanish were given a handout showing all of the pictures they would encounter during the experiment with their names in Spanish underneath (including an article to indicate the gender, e.g., *el ojo* ('the-masculine eye')). They were asked to let the experimenter know if there were any unfamiliar words. They were also told that if, during the experiment, they were unable to remember a particular word then they should make a guess or say *una cosa* ('a thing'), but still attempt to form a phrase.

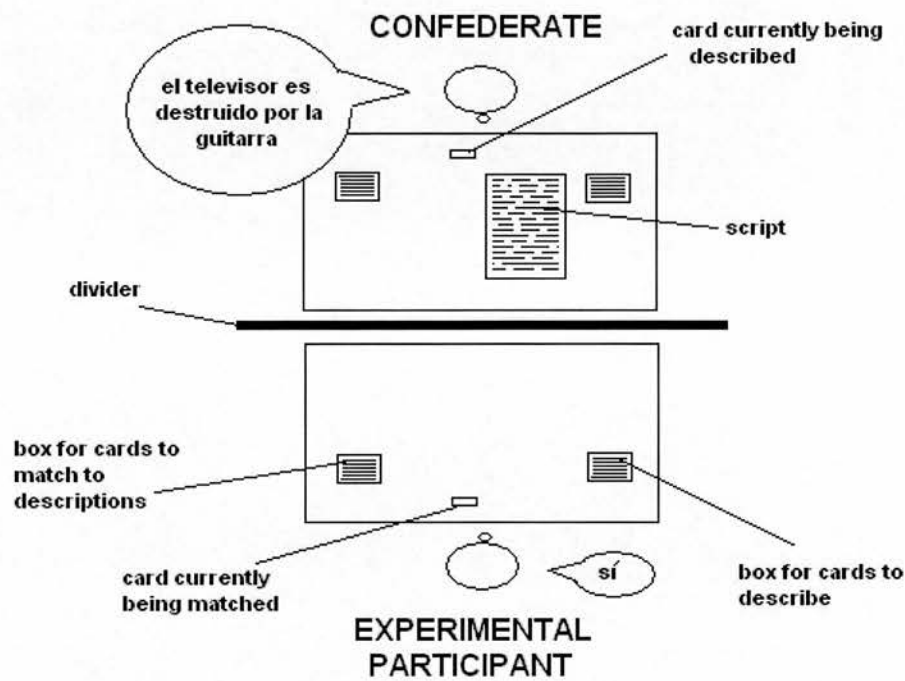


Figure 3-3: A diagram of the experimental layout for the dialogue task

The two participants sat on either side of a table with a high divider so that they could not see the other's desk or face. Naïve participants were unaware that the other person in the experiment was a confederate. Each participant had two small boxes on the desk in front of him or her. The naïve participant's Description cards were arranged in a red box on the desk in front of the naïve participant. In addition, the naïve participant had a blue box containing the naïve participant's Matching cards, to be matched to the confederate's descriptions. Both participants were told that their task was to decide on each turn whether or not the description from their partner matched the card shown. For half of the cards, one of the objects in the picture differed from the object mentioned in the confederate's description. The confederate also had a red and a blue box on her desk containing copies of the experimental cards. The confederate and participant alternated describing a picture for the other to match to his or her picture throughout the experiment, with the confederate always speaking first. After each confederate description the naïve

participant compared this to the top card in his or her matching set and said *sí* ('yes') if the description matched the picture, or *no* ('no') if the description and picture differed. These 'yes' and 'no' responses were distributed equally across conditions. The naïve participant then described a card from his description box, and the confederate pretended to compare this to a card and responded *sí* or *no*, according to her script (randomly specifying 50% *sí* responses and 50% *no*). Participants were told to describe the pictures using the word written beneath them, and were told that they could say *Repíte, por favour* ('please repeat'), but nothing else. The experimenter and the confederate behaved as if the confederate were a naïve participant throughout the experimental session.

There was a practice session before the experimental session, consisting only of cards depicting a single object with an adjective printed beneath (as in the fillers). The entire session lasted about 40 minutes. All participants completed a form with details about their age, education, and experience with their L2 (English in the case of the native Spanish speakers, Spanish in the case of the L2 Spanish speakers). The naïve L2 participants also completed the Cloze test after the experiment in order to assess their level of Spanish. Each confederate participated in an equal number of dialogues for each participant group.

The experimental session was recorded onto audiotape and subsequently transcribed. Every participant produced 24 target utterances, six in each of the four priming conditions defined by the combination of the Prime (Passive vs. Active) x Verb (Same vs. Different) factors. These factors were within-participants and items. Participant groups were also entered into the analysis as a between-participants and within-items factor (Native vs. Advanced vs. Intermediate).

3.6.4 Scoring

Each description of a target picture was scored as being Active, Passive or Other. Following Hartsuiker & Kolk (1998b) I used two scoring systems: lenient and strict.

In the lenient scoring system a transitive picture description was scored as an Active if it contained a single subject NP, followed by a transitive verb and then a single object NP. A transitive picture description was scored as a Passive if it contained a subject NP, followed by the auxiliary *estar* ('to be'), then a passive participle, and finally

a *por*-phrase ('by'-phrase) incorporating an object NP. I included utterances containing "surface" errors. Specifically, a description was counted as an active or passive if it met the criteria above, and in addition if it almost met the criteria above but made one or more of the following errors:

- Incorrect inflectional morphology on main verb (but correct verb stem)
- Use of the auxiliary verb *ser* instead of *estar*
- Use of *para*, *per* or *de* in place of the preposition *por*.

I used the lenient scoring criteria because many L2 speakers produced errors in descriptions which nonetheless had a clear correspondence to a Spanish active or passive. All other descriptions were counted as Others, and included intransitive descriptions (e.g., *la pelota se quema*, 'the ball burns') and conjunctions (e.g., *la casa y el fuego*, 'the house and the fire'). Instances where the participant missed a card or failed to give a description for any other reason were not included in the Other scoring.

In the strict scoring system, transitive utterances were only scored as Actives or Passives when they were grammatically correct in Spanish their entirety.

Analyses were performed on the lenient scores and on the strict scores, as well as on the incorrect scores only.

3.7 Results

I computed a measure designed to determine the relative proportions of passive target responses in each of the priming conditions. I focus the reporting of these results on production of passive structures, because the active is a highly frequent structure, and thus may be susceptible to ceiling effects. This measure was the number of passive target responses divided by the sum of all responses in that condition (Active, Passive and Others). Some previous studies have adopted a different measure of relative proportion, calculating the number of passive target responses divided by the sum of Active and Passive responses. However, only 2.7% of all responses in this study were Others, so the analysis would have been very similar for both calculations of proportions.

I then performed analyses of variance (ANOVAs) on these data treating participants ($F1$) and items ($F2$) as random effects.

3.7.1 Lenient Scoring

I began by analyzing the lenient-scoring data, which produced a total of 850 response, of which 180 (21.2%) were Passives, 647 (76.1%) were Actives and 23 (2.7%) were Others. Table 3-2 shows the number of passive target responses as a proportion of the total number of responses in each prime condition. Figure 3-5 shows the data in graphical format.

	Active, same verb	Active, different verb	Passive, same verb	Passive, different verb
L1	.03	.04	.25	.06
Advanced L2	.01	.06	.70	.39
Intermediate L2	.04	.07	.57	.32

Table 3-2: Proportion of passives produced by L1 and L2 speakers in Experiment 1 in each prime condition.

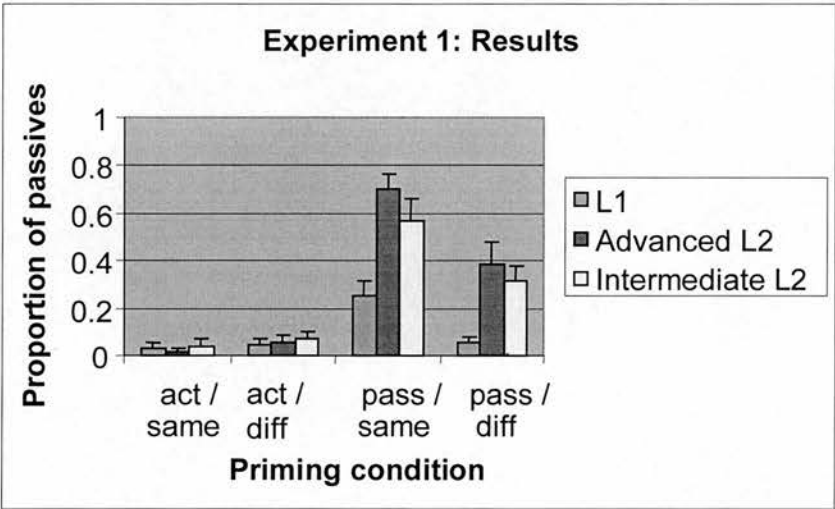


Figure 3-5: The proportion of passives produced by the three language groups (L1, Advanced L2 and Intermediate L2) in Experiment 1 across all conditions. The prime conditions were the following: act same (active prime, same verb in prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

I performed three-way ANOVAs on the results, with the factors Language Proficiency (L1 vs. Advanced L2 vs. Intermediate L2), Prime (Active vs. Passive), and Verb (Same Verb vs. Different Verb), on the proportion of passive target responses produced. (Note

that Prime and Verb were both within-participants and within-items factors, and Language Proficiency was a between-participants factor and a within-items factor). An effect of passive priming should be reflected as a significant effect of Prime, and a lexical boost should be reflected as a significant interaction of Prime and Verb. See Table 3-3 for the statistical outcomes of the analyses.¹⁶

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,33	109.867***	.042	1, 23	226.544***	.041
Verb	1,33	67.828***	.011	1, 23	19.715***	.046
Prime x Verb	1,33	36.811***	.013	1, 23	31.327***	.045
Language Proficiency	2,33	7.679**	.067	2, 46	49.843***	.021
Language Proficiency x Prime	2,33	11.905***	.042	2, 46	26.349***	.038
Language Proficiency x Verb	2,33	.349	.013	2, 46	.437	.022
Language Proficiency x Prime x Verb	2,33	1.224	.011	2, 46	.757	.036

Table 3-3: Statistical results of 3-way ANOVAs on the lenient scores, with Language Proficiency, Prime and Verb as factors.

There was a main effect of Prime, reflecting a priming effect: overall, participants were 34% more likely to produce a target utterance with the same structure as the confederate’s prime utterance than with an alternative structure. There was also a main effect of Verb: participants were more likely to produce a passive when the verb in the prime and target were the same than when they were different. This reflected a large lexical boost to priming in the Passive prime condition when the same verb was used, an effect more clearly observed as a significant interaction between Prime and Verb: Figure 3-5 shows that there was a 48% priming effect when the prime and target involved the same verb, and only a 20% priming effect when prime and target used different verbs.

¹⁶ Throughout the thesis, in accordance with standard notation, the *p* value is marked on the *F* values as follows:

No star = *p* > .05
* = *p* < .05
** = *p* < .01
*** = *p* < .001

In addition, where *p* values were between .05 and .10 (suggesting marginal significance) I include the *p* value in brackets after the *F* value.

Planned comparisons over each level of the Verb factor (paired in the participants and items analyses) demonstrated significant priming both when the verb was repeated between prime and target ($t(1(35)) = 9.29, p < .001$; $t(2(23)) = 8.66, p < .001$) and when it was not ($t(1(35)) = 4.58, p < .001$; $t(2(23)) = 4.16, p < .001$).

A main effect of Language Proficiency reflected a difference in the overall proportion of passives produced by each group. The L1 speakers produced 10% passive constructions over the whole experiment, the Advanced L2 speakers produced 29% and the Intermediate L2 speakers produced 25%. Planned comparisons showed the difference in the overall proportion of passives constructions produced by the Advanced and Intermediate L2 speakers to be significant by items only ($t(1(22)) = .71, p = .48$; $t(2(23)) = 2.96, p < .01$). However, there was a significant difference in the proportion of passives produced by the L1 speakers compared to both the Advanced ($t(1(22)) = 4.53, p = .001$; $t(2(23)) = 9.53, p < .001$) and Intermediate ($t(1(22)) = 3.07, p < .01$; $t(2(23)) = 6.35, p < .001$) L2 speakers.

There was also an interaction between Language Proficiency and Prime, showing a difference in the magnitude of the priming effect across the different participant groups. Planned comparisons across each level of the Prime factor revealed differences between the L1 group and the two L2 groups when the prime was a Passive. In the Passive condition the Advanced L2 speakers produced numerically more passives than the Intermediate L2 speakers, but this difference was significant by items only ($t(1(22)) = 1.0, p = .33$; $t(2(23)) = 3.2, p < .01$). However, planned comparisons did show differences in the proportion of passives produced after a Passive prime between L1 speakers and both the Advanced ($t(1(22)) = 5.1, p < .001$; $t(2(23)) = 10, p < .001$) and Intermediate ($t(1(22)) = 3.6, p < .005$; $t(2(23)) = 5.3, p < .001$) L2 speakers. There were no differences in the proportion of passives produced by the Intermediate and Advanced L2 speakers in the Active conditions ($ts < 0.9$). The L1 speakers also did not differ from either the Advanced ($ts < 0.15$) or Intermediate ($ts < 1$) L2 groups in the proportion of passives produced after an Active prime.

There was no interaction between Language Proficiency and Verb, and no three-way interaction between Language Proficiency, Prime and Verb, suggesting that the lexical boost to priming from repeating the verb was the same in all groups. To explore

this, I calculated a measure of the lexical boost for all three groups, by subtracting priming in the same-verb condition from that in the different-verb condition. The results of planned comparisons confirmed there was no difference in this lexical boost measure across groups (L1 vs. Advanced L2, $ts<1.5$; L1 vs. Intermediate L2, $ts<.9$; Advanced vs. Intermediate L2s, $ts<.9$).

I then performed separate ANOVAs over each level of the Language Proficiency factor, to investigate whether there were significant priming effects in each language group. Because the main analysis had produced no differences between the two L2 groups, I collapse the L2 data into one group. Table 3.4 shows the statistical outcomes of these ANOVAs, which yielded a significant main effect of Prime, an interaction between Prime and Verb, and a main effect of Verb for both the L1 and L2 speakers.

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
L1 speakers:						
Prime	1,11	6.217*	.016	1,23	7.881*	.029
Prime x Verb	1,11	8.505*	.013	1,23	9.471**	.024
Verb	1,11	16.206**	.015	1,23	9.857**	.017
L2 speakers:						
Prime	1,23	80.123***	.054	1,23	202.776***	.030
Prime x Verb	1,23	52.612***	.011	1,23	29.007***	.027
Verb	1,23	28.852***	.230	1,23	14.839**	.031

Table 3.4: Statistical results of 2-way ANOVAs with Prime and Verb as factors, performed separately for the L1 and L2 groups.

L1 speakers were 12% more likely to produce a passive following a passive prime than active prime (main effect of Prime), but this priming effect was stronger in the same-verb condition (22%) than in the different-verb condition (1%) (interaction between Prime and Verb). Planned comparisons over each level of the Verb factor demonstrated that for the L1 speakers there was significant priming when the verb was repeated between prime and target ($t1(11)=3.93, p<.01$; $t2(23)= 3.41, p<.01$) but not when the verb was different ($ts<0.6$).

L2 speakers were 45% more likely to produce a passive construction after hearing a passive prime than after an active (main effect of Prime); in the same-verb condition this tendency rose to 61%, significantly stronger than the 29% priming in the different-

verb condition. Planned comparisons (paired in the participants and items analyses) demonstrated significant priming both when the verb was repeated between prime and target ($t(23)=10.87, p<.001$; $t(23)=14.83, p<.001$) and when it was not ($t(23)=5.44, p<.001$; $t(23)=6.23, p<.001$).

Experiment 1 therefore showed significant priming in both L1 and L2 speakers, with stronger priming when the verb was repeated across prime and target than when it was different. However, although the L2 speakers showed significant priming both when the verb was the same and when it was different in prime and target, L1 speakers only showed significant priming when the verb was the same.

3.7.2 Strict Scoring

In addition to looking at the lenient data, I addressed whether the L2 speakers showed significant priming under the more strict scoring system. This could be argued to offer a more direct comparison to the L1 speakers, because only grammatically correct Spanish utterances were included for the L2 speakers. I therefore conducted repeated measures analyses (ANOVAs) on the strict scoring data only as had been done on the lenient data. For the L1 group the proportion of passives over the whole experiment was the same in the lenient and strict scoring (10%). There was, however, a decrease in the overall number of passives produced by both the L2 groups. The Advanced L2 speakers produced 29% passives in the lenient scoring and only 17% passives in the strict scoring. The Intermediate L2 speakers produced 25% passives in the lenient scoring and only 11% in the strict scoring. I return to the nature of the excluded 'incorrect' passives below. Table 3-5 shows the number of strict passive target responses as a proportion of the total number of responses in each prime condition. Figure 3-6 shows the data in graphical format.

	Active, same verb	Active, different verb	Passive, same verb	Passive, different verb
L1	.03	.04	.25	.06
Advanced L2	.00	.01	.48	.21
Intermediate L2	.04	.04	.22	.15

Table 3-5: The proportion of passives produced by L1, Advanced L2 speakers and Intermediate L2 speakers in Experiment 1 in each prime condition (strict scoring system).

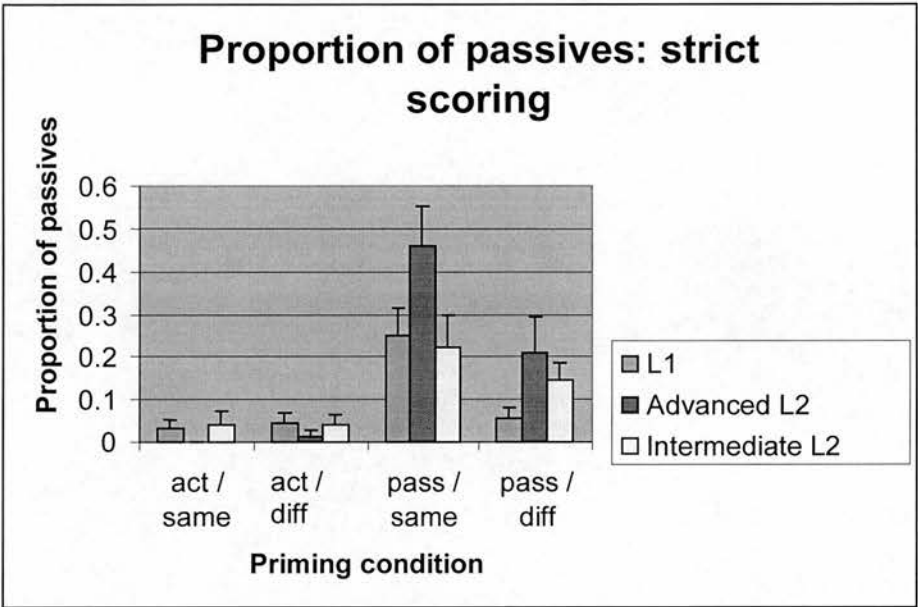


Figure 3-6: Proportion of passives produced in the strict scoring condition by the three language groups (L1, Advanced L2 and Intermediate L2) in Experiment 1 in each prime condition. The prime conditions were the following: act same (active prime, same verb in prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

I performed three-way ANOVAs with the factors Language Proficiency (L1 vs. Advanced L2 vs. Intermediate L2), Prime (Active vs. Passive), and Verb (Same Verb vs. Different Verb) on the proportion of passive target responses produced (note that Native Language was a between-participants factor and a within-items factor, and Prime and Verb were both within-participants and within-items factors). I conducted two ANOVAs, one with participants as a random factor ($F1$) and one with items as a random factor ($F2$). This produced a very similar pattern of results to the lenient scoring – see Table 3-6 for the statistical results of the ANOVAs.

As in the lenient-scoring analysis, there was a main effect of Prime, reflecting a priming effect. There was also an interaction of Prime with Verb, reflecting a lexical boost, and a main effect of Verb, with participants more likely to produce a passive when the verb in the prime and target were the same than when they were different. The main effect of Language Proficiency was significant by items only, in contrast to the lenient-scoring analysis. This reflects the fact that the proportion of responses scored as ‘passives’ was smaller for the two L2 groups than in the lenient analysis, making the number of passives similar to that in the L1 group. There was an interaction between Language Proficiency and Prime, showing a difference in the magnitude of the priming effect across the different participant groups. As before, however, there was no interaction between Language Proficiency and Verb, and no three-way interaction between Language Proficiency, Prime and Verb. Hence the lexical boost to priming from repeating the verb was the same in all three groups.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,33	38.468***	.035	1,23	95.049***	.028
Prime x Verb	1,33	22.384***	.013	1,23	29.582***	.021
Verb	1,33	14.705**	.017	1,23	18.677***	.027
Language Proficiency	2,33	1.344	.055	2,46	10.561***	.019
Language Proficiency x Prime	2,33	4.464*	.035	2,46	12.530***	.030
Language Proficiency x Verb	2,33	1.193	.017	2,46	2.313	.018
Language Proficiency x Prime x Verb	2,33	2.069	.013	2,46	1.540	.037

Table 3-6: Statistical results of 3-way ANOVAs on the strict-scoring data, with Language Proficiency, Prime and Verb as factors.

To investigate the interaction of Language Proficiency and Prime further, I performed planned comparisons (independent in the participants analysis, paired in the items analysis) across the different language groups over each level of Prime: see Table 3-7 for the statistical results of these tests.

Following an Active prime, overall there were no significant differences in the proportion of passives produced by the three language groups: the L1 speakers produced

3.8% passives, while the Advanced and Intermediate L2 groups produced respectively 0.7% and 4.2% ‘correct’ passives.

Following a Passive prime, the L1 speakers produced 15% passives, while the Advanced and Intermediate L2 groups produced respectively 33% and 18% ‘correct’ passives. There was no significant difference between the L1 and Intermediate L2 group, and the difference between the Intermediate and Advanced L2 groups was significant by items only. However, there was a significant difference between the L1 and Advanced L2 group.

Source of variance	t1		t2	
	df	t1 value	df	t2 value
Active prime				
L1 vs. Advanced L2	22	1.385	23	2.145*
L1 vs. Intermediate L2	22	.131	23	.327
Advanced vs. Intermediate L2	22	1.387	23	2.005
Passive prime				
L1 vs. Advanced L2	22	2.291*	23	5.550***
L1 vs. Intermediate L2	22	.860	23	1.197
Advanced vs. Intermediate L2	22	1.557	23	3.788**

Table 3-7: The statistical results of pair-wise comparisons on the proportion of ‘correct’ passives produced in each prime condition by each language group.

Thus, the interaction between Prime and Language Proficiency shows that passive priming (that is, proportion of passives produced after a passive compared to active prime) was stronger in the Advanced L2 group than in the L1 and Intermediate L2 groups. This contrasts with the results from the lenient scoring, which found passive priming to be stronger in the Intermediate L2 speakers than L1 speakers. This can be explained by the Intermediate L2 speakers making more errors, and thus suffering a larger reduction in proportions of passives through the strict scoring. For the Intermediates, there was around a 60% reduction in passives produced after a Passive prime; in contrast, for the Advanced L2 speakers there was less than a 40% reduction in proportion of passives produced after a Passive prime.

This section of the analysis has demonstrated significant priming effects in L1 and L2 speakers at two different proficiency levels, as well as a significant priming effect, even when only strictly correct passives were included for the L2 speakers. In the next

analysis I focus on the nature of the incorrect passives which were excluded from the L2 groups in the strict scoring system.

3.7.3 Analysis on L2 'incorrect' passives

The L2 speakers made several mistakes when producing utterances which nonetheless showed a clear correspondence to the passive form. These errors fell into three broad categories: verbal inflection errors, auxiliary verb errors, and preposition errors. Examples of each of these are shown in examples (i) to (iii) below (the first sentence in each example was the prime preceding the error-containing description, the English translations follow in inverted commas, and the word in bold indicates the error).

- (i) PRIME: *La cocina es rota por la naranja*
 'The cooker is broken by the orange'
 L2 TARGET: *El cigarro **rompido** por el balón*
 'The cigarette 'brokek' by the ball'
- (ii) PRIME: *La radio es golpeada por el sombrero*
 'The radio is hit by the hat'
 L2 TARGET: *La pelota **está** quemado por la fuego*
 'The ball 'is' burnt by the fire'
- (iii) PRIME: *El vino es ocultado por el pan*
 'The wine is hidden by the bread'
 L2 TARGET: *La fuesa es ocultada **para** la casa*
 'The fire is hidden 'for' the house'

Example (i) shows an inflectional error. The past participle of the verb *romper* requires an irregular form, which would be *roto* or *rota* (masculine and feminine forms, respectively), as given in the prime. The L2 participant over-regularised the participle, producing an incorrect form. Interestingly, errors of this type were observed even when the prime and target used the same verb, i.e., when the participant could potentially have re-used the correct form from the prime. This participant also omitted the auxiliary verb *ser* 'to be', despite having heard the form *es* in the prime. Example (ii) shows an error in choice of auxiliary. Spanish has two auxiliary verbs, *ser* and *estar*, which would both translate as 'to be' in English. The passive requires the *ser* form, but this L2 participant

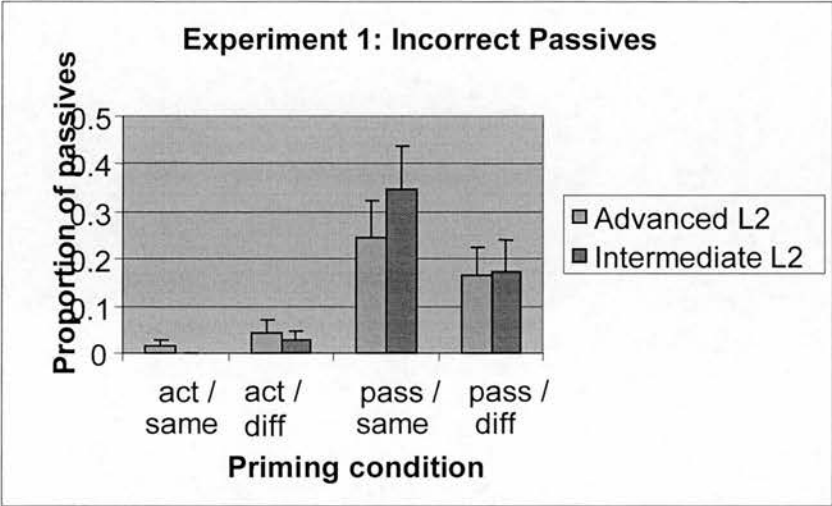
chose the *estar* form incorrectly. Example (iii) shows an error in the preposition used in the passive. The participant uses *para* instead of *por*, both of which are Spanish prepositions which can be translated as ‘for’ in English, so posing a problem for English learners of Spanish. However, in this case the correct preposition had already been demonstrated in the prime and could have been re-used by the naïve participant.

I performed an analysis on this data, which represented the ‘incorrect’ passives produced by L2 speakers (L1 speakers produced no ‘incorrect’ passives so were not included in this analysis). These minor errors make the surface form of the prime and target less similar. If priming and a lexical boost were seen even when the target was a grammatically deviant form, this would further support the hypothesis that the L2 priming is not due simply to repetition of the surface lexical elements of the prime. It would also imply that the representation which persists from prime to target in the L2 speakers is not specified for the surface morphophonological forms, but is a more abstract concept of the passive. Table 3-8 shows the number of incorrect passive target responses as a proportion of the total number of responses in each prime condition by the two L2 groups. Figure 3-7 shows the same data in graphical format.

	Active / Same verb	Active / Diff verb	Passive / Same verb	Passive / Diff verb
Intermediate L2	.00	.03	.35	.17
Advanced L2	.02	.04	.24	.17
Total	.01	.03	.29	.17

Table 3-8: The proportion of incorrect passives produced by the two L2 proficiency groups in Experiment 1 in each condition, as a proportion of the total responses in that condition.

I performed an initial three-way ANOVA only on the L2 data, with the factors Proficiency (Advanced vs. Intermediate), Prime (Active vs. Passive), and Verb (Same Verb vs. Different Verb) (note that Proficiency was a between-participants factor and a within-items factor, and Prime and Verb were both within-participants and within-items factors). This revealed significant effects of Prime and an interaction between Prime and Verb, but no significant differences between the Advanced and Intermediate L2 groups (all *F*s <1.5).



Error! Bookmark not defined.Figure 3-7: The proportion of incorrect passives produced by the two L2 proficiency groups in Experiment 1 across all conditions. The prime conditions were the following: act same (active prime, same verb in prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

I therefore collapsed the data into one group and will describe the data from this combined analysis. A two-way ANOVA on the combined data (see Table 3-9 for the statistical results of this analysis) revealed a significant main effect of Prime as well as a significant interaction of Prime and Verb: overall, 21% more incorrect passives were produced after passive primes than active primes, and the priming effect was 15% stronger in the same-verb than in the different-verb condition. This shows that the L2 priming effect cannot be attributed to a simple repetition of the surface form of the exemplars given in the prime constructions, since this priming effect was found in responses where the surface form of the prime was not repeated in the target; instead, it seems to reflect persistence of a more abstract representation of the passive.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,23	21.163***	.051	1,23	73.952***	.013
Prime x Verb	1,23	12.724**	.011	1,23	6.282*	.017
Verb	1,23	4.225 (p=.051)	.013	1,23	2.386	.015

Table 3-9: Statistical results of 2-way ANOVAs on the incorrect passives data as a proportion of total responses in each prime condition, with Prime and Verb as factors and collapsing data across the two L2 groups.

3.7.3.1 The nature of the incorrect passives

I also looked at the exact nature of the L2 errors produced, and how the prime condition might have affected the production of errors. Given that a participant produced a passive target, how did the prime influence whether or not that passive would contain a grammatical error? Table 3-10 shows the number of incorrect passives produced across the L2 speakers in each condition as a proportion of the total passives produced in that condition. The data is difficult to analyse statistically, because of the limited numbers and because only a subsection of the participants made errors, however general observations can be made. For example, the proportion of total passives containing an error is fairly similar regardless of the prime condition: it appears that a target passive preceded by a passive prime was not more likely to be correct than one preceded by an active prime. In addition, looking only at the incorrect inflections, when the prime was a passive the proportion of passives which were incorrect was very similar in the Same and Different Verb condition. This suggests that the overlap in verb did not make L2 speakers more likely to produce correct morphology, even with respect to the verbal inflections.

	Active / Same verb	Active / Diff verb	Passive / Same verb	Passive / Diff verb
Number of incorrect inflections	0 (0)	2 (.22)	17 (.21)	9 (.18)
Number of incorrect auxiliaries	1 (.25)	3 (.33)	21 (.24)	14 (.28)
Number of incorrect prepositions	0 (0)	0 (0)	4 (.05)	1 (.02)
TOTAL	1 (.25)	5 (.56)	39 (.44)	24 (.48)

Table 3-10: The number of incorrect passives produced in each condition by the L2 speakers, grouped by error-type. In brackets is shown what proportion this number is of the total passives produced in that condition (correct and incorrect). NB: The sum of the individual types of errors does not add up to the total number of incorrect passives because several target utterances contained more than one type of error.

3.7.4 The relationship between priming and L2 proficiency

In the analyses performed so far there were no significant differences between the two L2 groups in the proportions of passives produced across the different priming conditions. The absence of a reliable difference between the current groups could reflect that the

proficiency distinction between speakers in each group was not great enough. Although the L2 speakers were divided into 'Advanced' versus 'Intermediate' proficiency according to standard assessment tests, the proficiencies fell along a continuum, and it is possible that the proficiency profile of each group was not sufficiently distinctive.

However, if there is an effect of proficiency on priming, this would predict some relationship between any individual speaker's proficiency level and their susceptibility to priming. To examine this, I carried out correlation analyses to determine whether there was any relationship between the priming effect displayed by individual participants and their specific level of proficiency.

Relating the findings back to the introduction, I predicted stronger priming for speakers in the Intermediate L2 group than those in the Advanced L2 group. The correlation tests were therefore one-tailed. Under an account that links magnitude of priming inversely to frequency of exposure to L2 structures, priming magnitude is predicted to decrease with increasing proficiency: greater proficiency would be associated with greater exposure to the L2 (and hence to its structures). An account relating priming magnitude to native-speaker preferences for particular structures may also predict this inverse relationship to proficiency. If L1 speakers resist priming of a dispreferred structure, more proficient L2 speakers should have more native-like preferences for structures (although they may not converge on native-like preferences). I therefore performed four Spearman's Rho correlation analyses on individuals' proficiency in Spanish (Cloze test score) and the amount of priming the speaker displayed.

Firstly, I looked for a correlation between Cloze score and the amount of same-verb priming (proportion of passives in Passive/Same-Verb condition minus that in Active/Same-Verb condition). See Figure 3-8 for a scatter plot of the relationship. The analysis only approached significance, and in the opposite direction from that predicted (1-tailed analysis, $N=24$, $r=-.274$, $p=.097$). Secondly, I looked for a correlation between Cloze score and the amount of different-verb priming (proportion of passives in Passive/Different-Verb condition minus that in Active/Different-Verb condition). See Figure 3-9 for a scatter plot of the relationship. The correlation was not significant (1-tailed analysis, $N=24$, $r=.162$, $p=.224$). Thirdly, I looked for a correlation between Cloze

score and the amount of overall priming (the mean of same-verb and different-verb priming). See Figure 3-10 for a scatter plot of the relationship. The correlation was not significant (1-tailed analysis, $N=24$, $r=.105$, $p=.265$). Finally, I looked for a correlation between Cloze score and the amount of lexical boost (same-verb priming minus different-verb priming). See Figure 3-11 for a scatter plot of the relationship. The correlation was not significant (1-tailed analysis, $N=24$, $r=.028$, $p=.449$).

None of these correlations reached significance, hence we can be confident that there was no developmental trend in L2 priming in our group. The only correlation which even approached significance was the relationship between proficiency and the magnitude of priming in the same-verb condition. Interestingly, even this observed trend was not in the predicted direction. I had predicted that the relationship would be a negative one, with the amount of priming and lexical boost tending to decrease with increased proficiency, but the correlation coefficient in each case was positive.

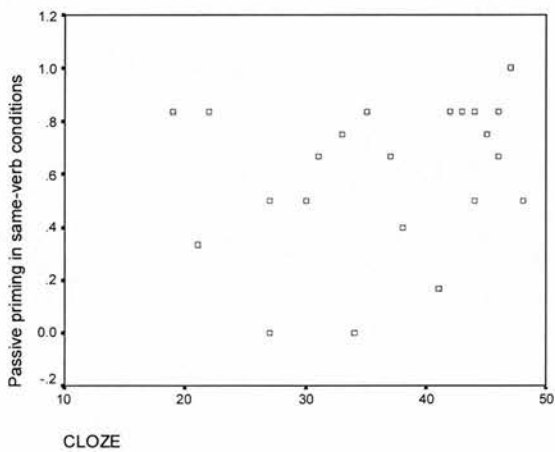


Figure 3-8: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of passive priming seen for that participant in the same-verb condition.

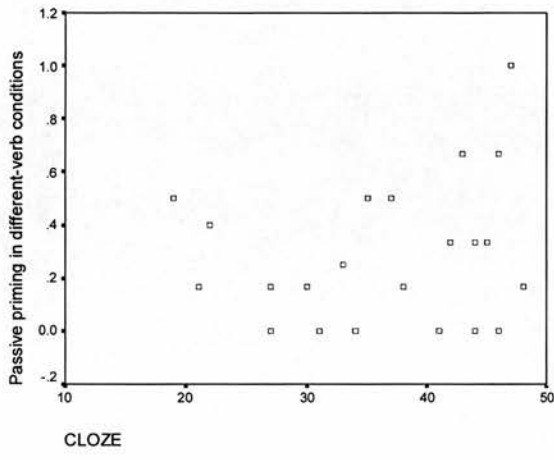


Figure 3-9: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of passive priming seen for that participant in the different-verb condition.

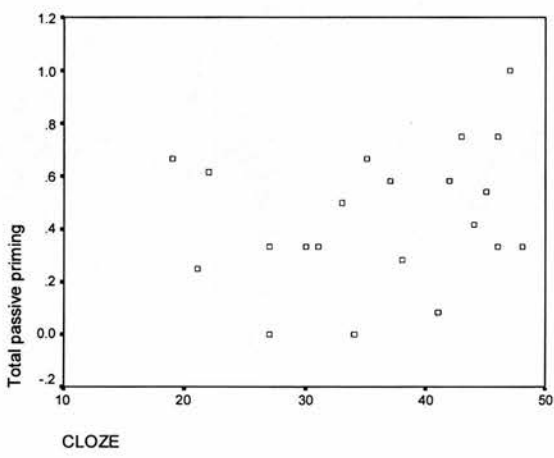


Figure 3-10: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of total passive priming seen for that participant across the whole experiment.

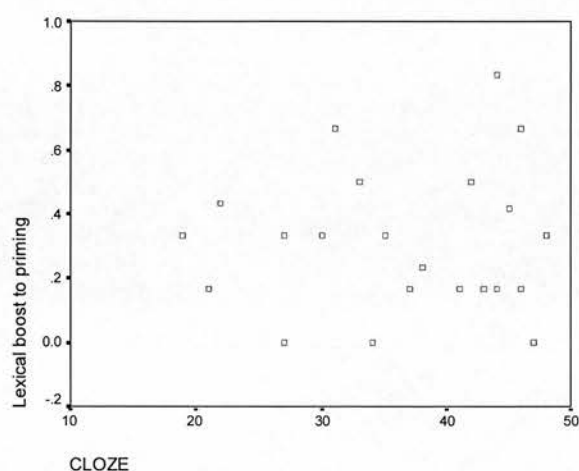


Figure 3-11: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of lexical boost to priming seen for that participant across the whole experiment.

3.7.5 The ‘Other’ responses

Finally, I looked at the nature of the utterances scored as ‘Others’, to explore any pattern which might have emerged. There were 23 ‘Others’ produced across the whole experiment. Of these Others, 3 were produced by Advanced L2 speakers, 10 by Intermediate L2 speakers, and 10 by L1 speakers.

The nature of the ‘Others’ were as follows: 7 were conjunctions (e.g., *El bate y la lampa queman*, ‘the bat and the lamp burn’), 5 were intransitive sentences (e.g., *Una carta quemando*, ‘a letter burning’), 1 was an OVS structure, and the other 10 were constructions in which the patient was the subject and the agent the object, but not using the *ser* passive form (e.g., *La casa está oculta tras el arbol*, ‘the house is hidden behind the tree’; *La lampa se destruye por la bicicleta*, ‘the lamp it destroys itself (reflexive form) because of the bicycle’).

I also considered whether there were effects of primes on the production of Others. For example, Hartsuiker et al. (2004) found a trend for passive targets to follow OVS primes, suggesting a persistence in the order of thematic roles, which they share (i.e., patient-verb-agent). However, there was no evidence in the current study for a passive priming an OVS structure: there was only one case in which a participant produced an OVS structure, and this was following an active prime (different verb). However, there was evidence that the *ser* passive primed other alternative constructions

which also placed the patient in subject position. Of the 10 Others consisting of a subject patient and object agent, 9 of them followed a passive prime. This suggests that comprehending a passive structure can prime a different construction in which the order of thematic roles is the same as in a passive. However, the numbers are too small to allow a proper statistical analysis, so I will not discuss this finding further.

3.8 Discussion

In Experiment 1, L1 Spanish speakers and Intermediate-Advanced L2 Spanish speakers for whom English is the L1 showed a tendency to use the same structure to describe a picture as they had just heard: they produced more passives after passives than after actives. For L2 speakers, this effect held even when they produced ungrammatical descriptions. The magnitude of the effect varied between L1 and L2 speakers: L2 speakers showed a stronger effect than L1 speakers. However, priming did not differ between the Intermediate and Advanced L2 speakers.

In addition, in both L1 and L2 speakers the priming effect was stronger when prime and target involved the same verb as when it was different. The L1 and L2 speakers showed no difference in the size of this lexical boost to priming, and the two L2 proficiency groups did not differ from each other in this respect. Finally, the L2 speakers showed priming in the presence and absence of lexical overlap, but the L1 speakers only showed priming when the verb was repeated across prime and target (although there was no 3-way interaction between Prime, Verb and Language Proficiency, so this observation is made with caution).

A primary aim of Experiment 1 was to establish a syntactic priming effect in L2 speakers; this would be evidence that similar syntactic representations and processing mechanisms are used in an L2 learned in adulthood as in a native language. The priming results of Experiment 1 are consistent with previous findings of syntactic priming in dialogue (e.g., Branigan et al., 2000; Hartsuiker et al., 2004) and extend demonstrations of syntactic priming to native speakers of Spanish. More importantly, they indicate that syntactic priming occurs in L2 Spanish speakers at both lower- and higher-proficiency levels.

These results constitute non-native priming when the prime and target were both in the L2. According to a persisting-activation account of syntactic priming (e.g., Pickering & Branigan, 1998; Branigan et al., 2000), the results are explained by L2 speakers possessing representations of the relevant information about the persisting syntactic form. When a particular syntactic form is read or heard, this representation is activated above resting level, and it takes time for this activation to decay. If the choice of syntactic form from several candidates is based on activation levels making one structure more available or more likely to be selected, this raised activation level makes the previously-processed structure more likely to be chosen in subsequent production.

Furthermore, both the Advanced and Intermediate L2 speakers showed priming when the verb was repeated across prime and target, and when it was different. Because lexical overlap is not necessary for priming to occur, we can conclude that even the lower-proficiency L2 speakers made use of abstractly-specified syntactic procedures that were independent of specific lexical items. This abstract knowledge of syntactic constructions is not, for example, found in young children who cannot generalise constructions to new lexical items (e.g., Tomasello, 1992; Tomasello & Brooks, 1998).

A second aim of this experiment was to establish the presence and nature of a lexical boost to priming in L2 speakers. I successfully demonstrated that lexical overlap between prime and target significantly increased priming in both the L1 and L2 groups. As described in the introduction, the lexical-boost observation has been well established in L1 priming (Branigan et al., 2000; Cleland & Pickering, 2003; Pickering & Branigan, 1998) and is interpreted as evidence for the primeability of connections between combinatorial information and individual lexical items. The finding of a similar lexical boost in L2 speakers supports an extension of this L1 architecture to L2 speakers. In addition, the magnitude of this lexical boost did not differ across language groups, suggesting that the processing architectures of L1 and L2 speakers do not differ importantly in terms of the lexical component of syntactic processing.

A third aim of the experiment was to look for developmental differences in priming effects and the lexical boost. In terms of overall magnitude of priming, there was no difference observed across the different L2 proficiencies, even through correlational analyses comparing proficiency with priming effects in individuals. However, both L2

groups displayed significantly stronger passive priming compared to the native group. Indeed, the L1 speakers did not show significant passive priming in the absence of lexical overlap across prime and target. I discuss explanations for this finding below. In addition, no developmental change was observed in the magnitude of the lexical boost across the three proficiency groups, suggesting that the processing architectures of L1 and L2 speakers do not differ importantly in terms of the lexical component of syntactic processing.

I now consider some of the implications of the current results in more detail: firstly, that priming was found even when the surface form of L2 utterances contained grammatical mistakes; secondly, that each of the three groups showed the same size of lexical boost; thirdly, that the L2 speakers show stronger priming overall than the L1 speakers.

3.8.1 Ungrammatical L2 structures

Results from Experiment 1 demonstrate similarities in L1 and L2 syntactic processing even when L2 speakers make errors in the surface form of the structure. The priming effects and lexical boost observed were significant both when only grammatically correct L2 descriptions were counted as ‘passives’, and when a more lenient scoring included L2 utterances containing morphological errors. The strict scoring system compared the native and non-native speakers by only scoring grammatically-correct ‘passive’ descriptions. The lenient scoring allowed L2 ungrammatical structures to be counted as passives as long as the surface form was similar enough to a well-formed passive; this doubled the number of L2 utterances scored as passives, offering more data for analysis. Nonetheless, similar patterns of priming emerged in both scoring systems.

An analysis only on the ungrammatical passive offered further evidence that the L2 representation of the passive is at an abstract level and not dependent on specific surface morphology. Significant priming was observed even when deviant syntax was produced in the L2 target, despite the correct syntax often being available in the prime. Hence these results cannot be explained in terms of verbatim repetition of (aspects of) the prime, and supports that these incorrect structures were intended as passives.

The fact that L2 speakers made errors when forming passive structures suggests that, for these L2 speakers, any representation of the passive is not yet fully formed in terms of the knowledge and processes involved in applying the correct morphophonology. This shows that priming can occur even when the processes involved in L2 syntactic production are still developing. This also supports that the persistence reflects activation of an abstract representation, not dependent on overlap in closed-class morphology. The L2 speakers are not simply repeating the surface structure of the prime, but seem to be processing a more abstract representation. As discussed in Chapter 2, previous studies have also shown priming occurs in the absence of repetition of closed class words, and that when the preposition or verbal morphology *is* repeated, this does not enhance the priming effect (Bock, 1989; Pickering & Branigan, 1998). The current findings also show reliable priming when the closed-class morphology varies in prime and target, further supporting that the overt instantiation of these grammatical elements is not intrinsic to the structures being primed.

3.8.2 Developmental effects on the lexical boost

In the introduction to this chapter I speculated on the nature of the acquisition of syntactic structures by adult L2 learners, and related predictions about priming in the absence and presence of lexical repetition. If adult L2 acquisition proceeds like child L1-development we could expect a verb-island effect in lower-proficiency learners: specific syntactic structures would be strongly linked to individual lexical heads, and not generalisable to other lexical items. In terms of syntactic priming, lower-proficiency learners would show little priming in a condition of no lexical repetition, but this would show a huge boost if the lexical head was repeated in prime and target. The discrepancy between priming in the absence and presence of lexical overlap should decrease with L2 proficiency¹⁷.

¹⁷ It should be noted that the L1 speakers in the study did not themselves show priming in the absence of lexical overlap, although this is unlikely to reflect verb islands in adult speakers given that adult L1 priming in the absence of lexical overlap is well established. The source of low priming in the different-verb condition is likely to reflect a tendency of L1 Spanish speakers to resist priming of the passive in general, as I shall argue in Chapter 5.

In contrast, if L2 speakers can transfer abstract combinatorial knowledge from the L1 to the L2 a strong verb-island effect would not be expected. The difference expected in the pattern of priming between L2 learners at varying proficiencies, and between L1 and L2 speakers, would not be so dramatic because abstract combinatorial information is available from the start of the acquisition process and priming in the absence of lexical repetition would be expected even in less proficient speakers.

The current results appear to support the latter viewpoint. Even Intermediate L2 learners showed significant priming in conditions of no lexical repetition, and there was no significant difference in the amount of priming seen in the Intermediate and Advanced speakers, suggesting combinatorial information was in place from lower-proficiency levels. It is impossible to draw strong conclusions on the basis of this study because it could always be argued that our Intermediate learners were already passed any 'lexical island' stage and we should look at real beginners to prove this is not the case. However, we chose the intermediate level because they already had some (limited) experience with the passive construction in Spanish, and also because with very low proficiency learners a lack of vocabulary would have made it hard to form appropriate materials using lexical items with which they were familiar. This demonstrates a limitation of performing this type of task with lower-proficiency L2 learners. Indeed, even the Intermediate learners we used were often far from fluent and made both lexical and grammatical mistakes in many of their descriptions.

It could be argued that this knowledge is in place early on because syntactic structures can be shared across languages. Previous evidence in the literature supports a model in which L2 speakers can share syntactic representations across languages if the same construction exists in both languages and is similar enough in form (e.g., Hartsuiker et al., 2004; Hartsuiker et al., 2005). These models were based on studies demonstrating cross-linguistic priming in bilinguals (therefore implying shared syntactic representations between languages) who were very advanced speakers of the L2. However, even if combinatorial knowledge can be shared across languages, there are still other aspects of processing which must be acquired. For example, the morphophonological correlates of the structure in the L2, and mappings between L2 lexical items and these structures. Explaining an L2 priming effect through syntactic structures having been transferred

directly from an L1 also raises implications for structures that exist in the L2 but not the learner's L1 (explored further in subsequent chapters). The current study showed priming in a purely L2 context, and so does not offer direct support for syntactic structures being directly shared across languages even in Intermediate L2 speakers. A more conservative account of the results would therefore be that knowledge about syntactic categories and constructions can be imported by early L2 learners into the new language from their L1, and so the verb-island acquisition process seen in child is not necessary in adults.

3.8.3 Developmental differences in magnitude of priming

The results of this experiment showed significantly stronger priming in the L2 speakers compared with L1 speakers (although no difference in the two L2 groups). One interpretation of this result is that L2 speakers' syntactic systems are more open to influence from preceding context (i.e., linguistic input) than L1 speakers' syntactic systems, and that this manifests itself in terms of a greater susceptibility to syntactic priming. As discussed in the introduction, this hypothesis makes good sense in the context of an account that assumes that the impact of the prior activation of a syntactic structure is mediated by the resting activation level of that structure. However, under this account, differences in L2 priming should vary as a function of proficiency: the magnitude of priming should be inversely proportional to language experience and so proficiency. I failed to find any effects of proficiency on the magnitude of priming in the L2 speakers. If anything there was strongest priming in the Advanced L2 speakers as a group; the trend was numerically in the opposite direction (e.g., 51% for Advanced group vs. 39% for Intermediate group). Furthermore, such an account would predict L2 speakers would always display stronger priming than L1 speakers, a prediction I test more directly in Chapter 5.

On the basis of the absence of any correlation between L2 proficiency and magnitude of priming in Experiment 1, alternative explanations for why the L2 speakers might have shown stronger priming than the L1 speakers seem more convincing. Firstly, L1 speakers may resist priming of a structure like the passive, which they strongly disprefer, while L2 speakers remain insensitive to the infelicitousness of this structure in the new language. This would be supported by the fact that the L1 speakers showed no

priming in the absence of lexical overlap – perhaps lexical boost was required to overcome resistance to passive priming. It could be argued that this account also predicts that priming would decrease with increasing L2 proficiency, as L2 speakers converge on native-like preferences. However, there is evidence to show that very advanced L2 speakers may continue to overuse inappropriate constructions in the target language (e.g., Oshita, 2001; Sorace, 2005). Therefore, the lack of correlation would not necessarily constitute evidence against this account.

Secondly, there may be a transfer of preferences for a structure from the L2 speakers' L1. That is, because the passive is a relatively frequent option in English but rare in Spanish, L2 speakers of Spanish with English as a native language may transfer this acceptability across languages and so be more likely to use passives than L1 speakers of Spanish. In keeping with this, the L2 groups in the experiment described above produced significantly more passives overall compared to the L1 speakers. I return to these issues in Chapter 5, which addresses the two explanations directly.

A final potential explanation for the difference in priming across L1 and L2 speakers was due to the experimental set-up. In Experiment 1, both L1 and L2 speakers tended to repeat syntactic structures when playing a picture-description and –matching game with a native Spanish speaker, but this effect was stronger in L2 speakers than in L1 speakers. The L2 speakers may therefore feel social pressure to conform to the speech of the native confederate, leading to inflated priming. In Chapter 4 I attempt to study syntactic priming in the absence of such social factors.

3.9 Summary

Experiment 1 found evidence for syntactic priming in both L1 and L2 speakers of Spanish at Intermediate and Advanced levels of proficiency. Priming was stronger for the L2 speakers compared to the L1 speakers, but was not correlated with L2 proficiency; in contrast, the lexical boost to priming conferred by verbal overlap was comparable across groups. Taken together, the results of Experiment 1 are consistent with the hypothesis that L1 and L2 speakers make use of similar abstract syntactic processes and representations during language processing. However, under at least some circumstances, L2 speakers appear to be more susceptible to syntactic priming effects.

4 Excluding social influences on priming

4.1 Overview

In Chapter 3 we saw evidence from syntactic priming of actives and passives in L1 and L2 Spanish production that similar syntactic representations and processing mechanisms appear to underlie L1 and L2 sentence-level production. However, Experiment 1 showed L2 speakers to produce significantly stronger priming than the L1 speakers, though L2 groups at two different proficiencies did not differ.

In this chapter I explore the idea that priming magnitude across the L1 and L2 speakers could be differentially affected by the presence of a native speaker interlocutor. Greater L2 priming may be due to social pressure to conform to the speech style of the 'expert' native interlocutor, which an L2 speaker would feel more strongly than another native, as opposed to factors intrinsic to the L2 linguistic system.

I begin this chapter with some background to the concerns about social pressures in a dialogue situation. I then discuss possible ways to avoid this experimentally. In the remainder of the chapter, I present an experiment designed to remove social pressures. This experiment used the same materials as in Chapter 3, but the participants saw pictures and prime sentences on a computer screen as opposed to hearing them from a native speaker. Experiment 2 therefore also served to replicate Experiment 1 using a different experimental setting and different modality of prime input, allowing an investigation of the robustness of Experiment 1's findings.

4.2 Social effects within dialogue

Previous research has shown that speakers' behaviour is influenced by the perceived expertise of their interlocutor in a dialogue (e.g., Isaacs & Clark, 1987). For example, speakers tend to adopt the terminology of their interlocutor depending on their belief about the expertise in the relevant domain (e.g., Isaacs & Clark, 1987) and native speakers certainly adapt their speech to align with non-native speakers (e.g., Bortfeld & Brennan, 1997). Bortfeld and Brennan got native and non-native speakers who could not see one another to describe different types of chairs to each other. They found that L2 speakers lexically aligned to L1 speakers (e.g., non-natives would acquire idiomatic

terms for particular chair types over the course of the experiment). Interestingly, they also found the native speakers adjusted their lexical descriptions to match those of the non-natives, even when this meant using phrases they would not normally choose (e.g., referring to a chair with wheels as a chair 'with five little tires').

There may therefore be pressure on L2 speakers to adapt to the speech of the 'expert' native speaker and this pressure could be greater for the L2 than L1 speakers. There is also extensive evidence that speakers' convergence with an interlocutor can be influenced by social psychological factors (e.g., Giles and Powesland, 1975). Speakers will adapt to another's communicative behaviour to gain social approval. For example, Giles and Powesland (1975) found that when a speaker's accent was perceived to have a higher social status, their speech had a greater impact on another's opinions.

The type of conforming behaviour I am concerned with in this thesis is syntactic alignment. In Experiment 1, participants interacted with a native Spanish-speaking confederate. L2 speakers were more likely to be influenced by the syntactic structure used by the confederate than were L1 controls. In the case of L2 speakers, a native Spanish-speaking interlocutor might be perceived as an 'expert' in the domain of the Spanish language. As such, L2 speakers might be more likely to conform to the confederate's speech than L1 speaker participants, for whom the confederate would be assumed to have the same level of linguistic expertise as themselves. The stronger priming for L2 speakers than for L1 speakers might not therefore reflect any intrinsic differences in syntactic representation or processing between the L1 and L2 groups, but rather differences in any social pressure to conform that speakers in each group might have felt.

In addition, social pressures may explain the lack of difference in priming across the two L2 groups in Experiment 1. It could be that more advanced speakers would naturally show less priming due to more entrenched structures than intermediate speakers. However, the higher-proficiency L2 speakers had been recruited because of declared advanced knowledge of Spanish. As such, they may have felt a need to prove their proficiency by using more varied and complicated structures, like the passive, and pressure to keep in line with the speech of the interlocutor. This could contribute additional social pressure on the Advanced L2 speakers compared to the less-fluent L2

speakers and be a possible explanation for why there was no difference in the amount of priming seen across the L2 speakers.

4.3 Removing the social pressure in the experiment

In Experiment 2 I therefore aimed to remove any social pressure created by the presence of a native interlocutor. A possible approach would be to repeat the dialogue game using a confederate with L1 English and L2 Spanish. However, this could serve to create additional social pressures. If the perceived status of an interlocutor *does* affect syntactic priming, presumably the perceived proficiency of the L2 speaker would also affect the magnitude of alignment. For example, a very proficient L2 speaker may be perceived as an expert and so have a similar effect on the L2 participants as a native confederate, encouraging more syntactic alignment. A less-proficient L2 confederate could have the opposite effect, and cause less alignment in the other L2 speakers due to lack of confidence in the correctness of the confederate speech. The perceived proficiency of the L2 confederate would itself be difficult to control. Finally, there is the evidence that L1 speakers tend to conform to the speech of L2 speakers, even if this means use of non-native vocabulary (Bortfeld & Brennan, 1997). There could therefore also be an increase in the natural tendency of the L1 participant group to align with the confederate.

In order to investigate L2 mental syntactic representations in the absence of such social pressures, I used a design that removed the interlocutor from the task. Experiment 2 employed a picture-description and -matching task using the same materials as in Experiment 1, but presented on a computer screen rather than as part of a face-to-face dialogue. In addition, participants were not told that their descriptions would be heard or judged by a native speaker, so that they were not designing their utterances for a specific audience. The modality of prime input was also changed, from spoken primes (which would carry an accent, and thus potential social pressures to conform) to typed primes which the participants read from the computer.¹⁸

¹⁸ It could be argued that a computer also creates social pressures if, for example, people treat the computer as an 'expert' and so aim to conform to the computer presentation. In addition, participants would be aware that someone had written the computer programme, presumably the experimenter (also an L2 speaker of Spanish), which could also be argued to have a social effect. However, the participants were mostly students and young professionals who were familiar with using computers in their day-to-day life, and they were not given any details of who had designed or would analyse the experiment.

If the differences in magnitude of priming observed across the L1 and L2 speaker groups in Experiment 1 were influenced by interacting with a co-present native Spanish confederate, these differences should reduce when the confederate is replaced by a computer program.

4.4 Experiment 2: computer replication of Experiment 1

4.4.1 Participants

48 further naïve participants were paid £5 to take part in the experiment. 16 participants were native speakers of Spanish from Spain and the other 32 were native speakers of English who had learned Spanish as a second language after the age of 13. The same criteria were used in evaluating language proficiencies as in Experiment 1 (see Table 4-1 for details).

Participant Group	Age	Time in L2 country (months)	Cloze test score (out of 50)
Natives	24 (2.7)	3.0 (4.5)	50 (0.5)
Advanced L2	23 (3.8)	22 (27)	43 (3.3)
Intermediate L2	28 (10.8)	4.8 (4.6)	28 (6.2)

Table 4.1: Details of the 3 participant groups used in Experiment 2. The figures are means for each group, with standard deviation shown in brackets.

4.4.2 Materials

The same pictures and sentences were used as in Experiment 1, except that all the pictures were presented on a computer screen, and the confederate’s scripted descriptions were presented as printed text (Font: Arial) on a computer screen.

4.4.3 Procedure

Participants sat in front of a computer and were told that the experiment involved two tasks, matching descriptions to pictures, and describing pictures. The experiment was presented using E-Prime software (Cohen, MacWhinney, Flatt, & Provost, 1993).

There was a practice session before the experimental session consisting only of filler sentences and pictures. At the beginning of the experimental session a written phrase appeared on the computer screen in Spanish. The participant was instructed to read this phrase in silence and, when ready, to press the space bar. A picture then appeared on the screen and the participant was required to say *sí* if the description matched the picture and *no* if the description and picture differed. After responding aloud, the participant pressed the space bar again and a new picture appeared on the screen with “...” underneath it to indicate a description was required. The participants were instructed to describe this picture in Spanish using the word printed below the picture. After completing a description, participants pressed the space bar again. This caused a new Spanish phrase to appear on the screen, which they read and then compared to the subsequent picture. There was no time limit, and the whole experiment took around 1 hour for the non-native speakers and 45 minutes for the natives.

The phrase/picture comparison and the picture description tasks alternated throughout the experiment, with the phrase/picture comparison always preceding a description task. Unless otherwise indicated, the procedure was as in Experiment 1 (see section 3.6.3).

4.4.4 Scoring

As in Experiment 1 (see section 3.6.4).

4.5 Results

As in Experiment 1, I computed a measure designed to determine the relative proportions of passive target responses in each of the priming conditions. This measure was the number of passive target responses divided by the sum of all responses in that condition (Active, Passive and Other). In all cases, two analyses of variance (ANOVAs) were performed, treating participants ($F1$) and items ($F2$) as random effects respectively.

4.5.1 Lenient Scoring

I began by analyzing the lenient-scoring data. The lenient scoring produced a total of 1140 responses, of which 209 (18.3%) were Passives, 907 (79.6%) were Actives and 24 (2.1%) were Others.

Table 4-2 shows the number of passive target responses as a proportion of the total number of responses in each prime condition. Figure 4-1 shows the same data in graphical format.

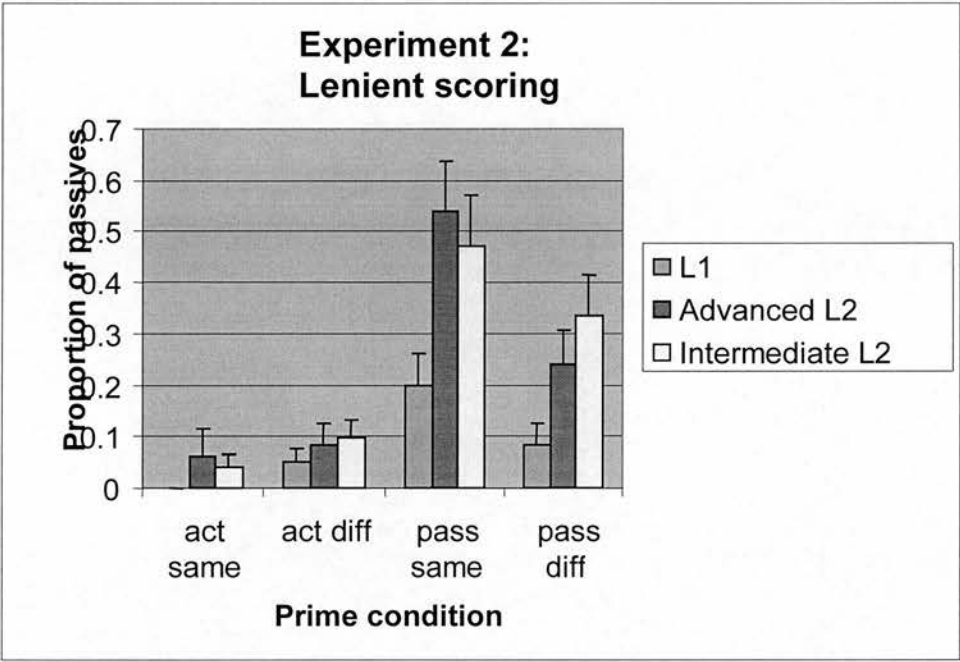


Figure 4-1: The proportion of passives produced by the three language groups (L1, Advanced L2 and Intermediate L2) in Experiment 2 across all conditions. The prime conditions were the following: act same (active prime, same verb between prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

	Active, same verb	Active, different verb	Passive, same verb	Passive, different verb
L1	.00	.05	.20	.08
Advanced L2	.06	.08	.54	.24
Intermediate L2	.04	.10	.47	.33

Table 4-2: Proportion of passives produced by L1 and L2 speakers in Experiment 2 in each prime condition.

I performed three-way ANOVAs as in Section 3.7.1. Table 4-3 shows the statistical outcomes of the analyses. As can be seen in Figure 4-1, there was a significant priming effect (main effect of Prime): participants were 25% more likely to produce a passive target following a passive prime than an active prime. There was also a significant main effect of Verb, reflecting the large increase in passives when the prime and target used the same verb. More interestingly, there was a significant interaction between Prime and Verb. Participants showed a 37% priming effect when the prime and target involved the same verb, and a 14% priming effect when they involved different verbs. Planned comparisons across both levels of Verb (paired in the participants and items analyses) revealed reliable priming both when the verb was repeated ($t_1(47) = 7.05, p<.001$; $t_2(23) = 8.82, p<.001$) and when it was not ($t_1(47) = 4.51, p<.001$; $t_2(23) = 4.93, p<.001$).

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,45	50.397***	.062	1, 23	124.766***	.037
Prime x Verb	1,45	31.642***	.019	1, 23	22.326***	.037
Verb	1,45	11.214**	.021	1, 23	6.841*	.039
Language Proficiency	2,45	3.614*	.133	2, 46	17.709***	.040
Language Proficiency x Prime	2,45	3.814*	.062	2, 46	12.328***	.031
Language Proficiency x Verb	2,45	2.761	.021	2, 46	3.495*	.035
Language Proficiency x Prime x Verb	2,45	1.409	.019	2, 46	1.824	.032

Table 4-3: Statistical results of 3-way ANOVAs on the three language groups on the lenient-scoring data from Experiment 2, with Language Proficiency, Prime and Verb as factors.

In terms of effects involving Language Proficiency, there was no difference in the behaviour of the two L2 groups, but significant differences between both the L2 groups compared to the L1 speakers. A main effect of Language Proficiency reflected that the L1 speakers produced less passives overall (8%) than both the Advanced (23%) and Intermediate (23%) L2 speakers, but the L2 groups did not differ from each other. This was confirmed by planned comparisons (L1 vs. Advanced: $t_1(30)=2.63, p<.05$; $t_2(23)=5.69, p<.001$; L1 vs. Intermediate: $t_1(30)=2.50, p<.05$; $t_2(23)=6.08, p<.001$; Advanced vs. Intermediate: $ts<.19$)

There was also an interaction between Language Proficiency and Prime, showing differences in the magnitude of the priming effect across the different participant groups. I explored this interaction further, using planned comparisons across each level of Prime. These revealed no differences in the proportions of passives produced by the Intermediate and Advanced L2 speakers both after an Active and after a Passive prime ($ts < 0.3$). Following an Active prime the L1 speakers also did not differ from either the Advanced ($ts < 1.9$) or Intermediate ($ts < 1.6$) L2 groups in the proportions of passives produced. However, planned comparisons did show differences in the proportions of passives produced after a Passive prime between L1 speakers and both the Advanced ($t(1(30)) = 2.9, p < .01$; $t(2(23)) = 6.5, p < .001$) and Intermediate ($t(1(30)) = 2.5, p < .05$; $t(2(23)) = 5.7, p < .001$) L2 speakers. Following a Passive prime, the Intermediate and Advanced L2 speakers groups produced, respectively, 39% and 40% passives, compared to 14% in the L1 group.

There was, however, no interaction between Language Proficiency and Verb, and no three-way interaction between Language Proficiency, Prime and Verb, suggesting the lexical boost was the same in all groups. To explore this, I calculated a measure of the lexical boost for all three groups, by subtracting priming in the same-verb condition from that in the different verb condition). The results of planned comparisons confirmed there was no difference in this lexical boost measure across groups (L1 vs. Advanced L2, $ts < 1.9$; L1 vs. Intermediate L2, $ts < .6$; Advanced vs. Intermediate L2s, $ts < 1.2$).

4.5.2 Lenient Scoring: separate ANOVAS for L1 and L2 data

I then explored the L1 and L2 data separately. Because no significant differences emerged in the grand ANOVA between the L2 groups, I collapsed the data for the two L2 groups. I then performed separate ANOVAs for the L1 and pooled L2 data.

Both the L1 and L2 analyses yielded a significant main effect of Prime, an interaction between Prime and Verb. Table 4-4 shows the statistical outcomes of these ANOVAs:

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F1 value	MSe
L1 speakers:						
Prime	1,15	5.056*	.042	1,23	18.849***	.014
Prime x Verb	1,15	12.000**	.009	1,23	4.981*	.022
Verb	1,15	1.000	.016	1,23	.027	.018
L2 speakers:						
Prime	1,31	48.486***	.069	1,23	115.593***	.023
Prime x Verb	1,31	21.173***	.025	1,23	17.684***	.020
Verb	1,31	10.037**	.026	1,23	8.903**	.019

Table 4-4: Statistical results of 2-way ANOVAs with Prime and Verb as factors, performed separately for the L1 and L2 groups.

The L1 speakers were 11% more likely to produce a passive following a passive prime than an active prime (main effect of Prime), and this priming effect was larger in the same-verb condition than in the different-verb condition (20% vs. 3% priming) (interaction of Prime and Verb). Planned comparisons across each level of the Verb factor demonstrated that for the L1 speakers there was significant priming when the verb was repeated between prime and target ($t(15) = 3.05$, $p < .01$; $t(23) = 3.90$, $p < .01$) but not when the verb was different ($ts < 1.3$).

The L2 group were 32% more likely to produce a passive construction after hearing a passive prime than after an active (main effect of Prime); in the same-verb condition this tendency rose to 45%, significantly stronger than the 20% priming in the different-verb condition (interaction of Prime and Verb). Planned comparisons over each level of the Verb factor demonstrated significant priming both when the verb was repeated between prime and target ($t(31) = 6.76$, $p < .001$; $t(23) = 10.0$, $p < .001$) and when it was not ($t(31) = 5.21$, $p < .001$; $t(23) = 5.49$, $p < .001$).

These results therefore replicate Experiment 1 in finding a priming effect in L1 and L2 speakers of Spanish, with stronger priming when the verb was repeated across prime and target than when it was different.

4.5.3 Strict Scoring

As for Experiment 1, I performed the same ANOVAs on the strict-scoring data as on the lenient-scoring data (see section 4.5.2). For the L1 group the proportion of passives was the same in the lenient and strict scoring (10%). However, there was a decrease in the overall number of passives produced by both the L2 groups: the Advanced L2 speakers produced 23% passives in the lenient scoring and only 11% passives in the lenient scoring; the Intermediate L2 speakers produced 24% in the lenient scoring and only 12% in the lenient scoring. I return to the nature of these ‘incorrect’ passives below. Table 4-5 shows the number of strict passive target responses as a proportion of the total number of responses in each prime condition. Figure 4-2 shows the same data in graphical format.

	Active, same verb	Active, different verb	Passive, same verb	Passive, different verb
L1	.00	.05	.20	.08
Advanced L2	.01	.01	.35	.08
Intermediate L2	.02	.03	.24	.19

Table 4-5: The proportion of passives produced by L1, Advanced L2 speakers and Intermediate L2 speakers in Experiment 2 in each prime condition (strict scoring system).

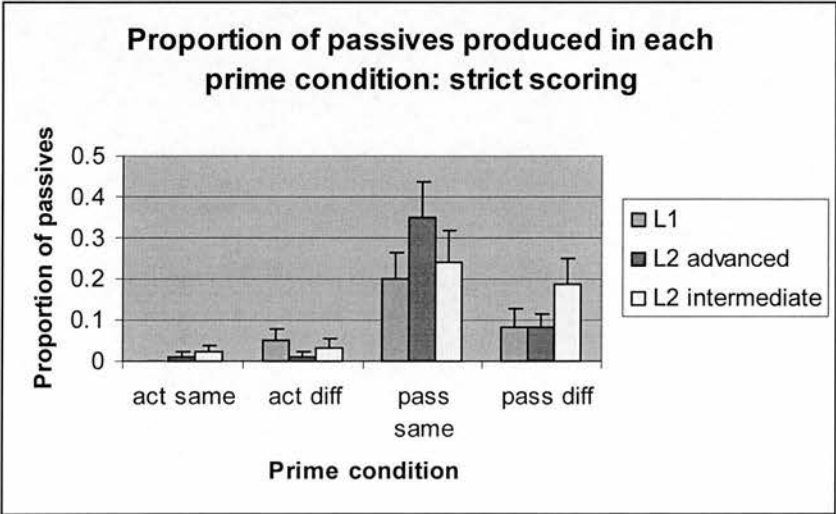


Figure 4-2: Proportion of passives produced by each language group in the strict scoring data (L1, Advanced L2 and Intermediate L2) in Experiment 2 in each prime condition. The prime conditions were the following: act same (active prime, same verb between prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,45	28.468***	.049	1,23	51.623***	.038
Prime x Verb	1,45	31.977***	.010	1,23	16.177**	.024
Verb	1,45	17.168***	.011	1,23	9.151**	.021
Language Proficiency	2,45	.352	.070	2,46	2.662 (p=.081)	.015
Language Proficiency x Prime	2,45	.785	.049	2,46	4.061*	.041
Language Proficiency x Verb	2,45	5.836**	.011	2,46	6.779**	.018
Language Proficiency x Prime x Verb	2,45	4.115*	.010	2,46	4.784*	.015

Table 4.6: Statistical results of 3-way ANOVAs on the strict-scoring data, with Native Language, Prime and Verb as factors.

Table 4-6 gives the statistical results of these ANOVAs. As in the lenient-scoring analysis, there was a main effect of Prime, reflecting a priming effect: participants were more likely to produce a passive target after a passive prime than after an active prime. There was an interaction of Prime with Verb, reflecting that priming was stronger when the verb was repeated across prime and target. The main effect of Verb was also significant, with participants more likely to produce a passive when the verb in the prime and target were the same than when they were different (Figure 4-3 shows this is likely to reflect the large lexical boost in the Passive prime conditions).

As in Experiment 1, adopting the ‘strict’ scoring system did, however, remove differences between the groups. There was no main effect of Language Proficiency, indicating that similar numbers of passives were produced overall by each participant group. The interaction between Language Proficiency and Prime was marginally significant (by items only), showing the magnitude of the priming effect to be similar across the different participant groups. There were, however, interactions between Language Proficiency and Verb and between Language Proficiency, Prime and Verb. Because there were so few passives produced after an Active prime, regardless of prime, this effect is likely to reflect responses in the Passive prime conditions. Figure 4-2 suggests that, although there was a lexical boost to priming in all groups, this was numerically larger in the Advanced L2 speakers than the Intermediate L2 or L1 speakers.

This was explored by calculating a measure of the lexical boost by taking the difference between priming in the same-verb condition and the different-verb condition, and performing planned comparisons on this measure across each language group. However, none of these comparisons reached significance, reflecting a similar lexical boost across all three language groups (L1 vs. Advanced: $ts < .7$; L1 vs. Intermediate: $ts < 1.5$; Advanced vs. Intermediate: $ts < 1.7$).

Because the lenient scoring analysis produced no differences in the two L2 groups, differences emerging in the strict-scoring condition must reflect the number of ‘incorrect’ passives in each condition, removed for this analysis. I investigated this by looking at the pattern of effects of incorrect targets.

4.5.4 Analysis on incorrect passives only

A separate analysis was performed on the ‘incorrect’ passives produced by the L2 speakers. As in Experiment 1, these errors fell into three broad categories of mistakes: verbal inflection, auxiliary verb, and preposition errors (see 3.7.3 for examples of errors). In addition, participants sometimes made errors in more than one of these grammatical aspects in a single response. Table 4-7 shows the number of incorrect passives produced by each L2 group in after each prime condition, as a proportion of the total number of responses in that condition. Figure 4-3 shows the same data in graphical format.

	Active / Same verb	Active / Diff verb	Passive / Same verb	Passive / Diff verb
L2 intermediate	.05	.07	.19	.16
L2 advanced	.02	.07	.23	.15
Total	.04	.07	.21	.15

Table 4-7: The proportion of incorrect passives produced by the two L2 proficiency groups in Experiment 1 in each condition, as a proportion of the total responses in that condition.

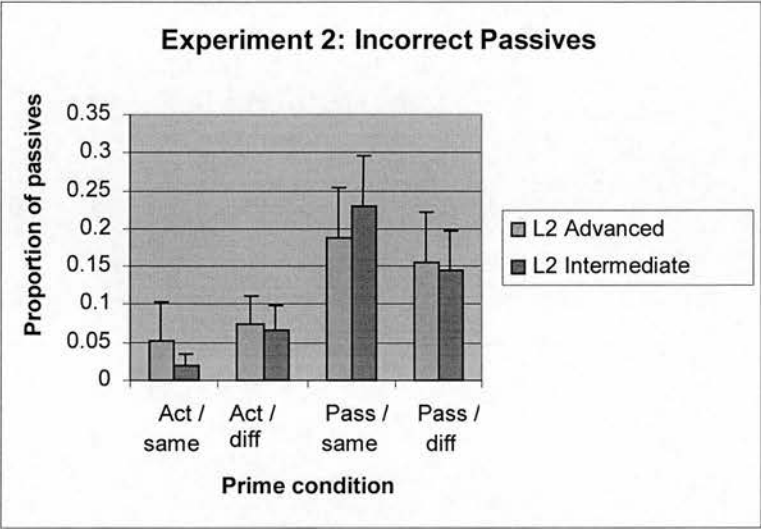


Figure 4-3: The proportion of incorrect passives produced by the two L2 proficiency groups in Experiment 2 in each condition (as a proportion of the total responses in that condition). The prime conditions were the following: act same (active prime, same verb between prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

I performed three-way ANOVAs on this L2 data, as in section 3.7.3. This revealed significant effects of Prime and an interaction between Prime and Verb, but no significant differences between the Advanced and Intermediate L2 groups (all F s <1). I therefore collapsed the data into one L2 group, and performed two-way ANOVAs with only the factors Prime and Verb. An analysis of this combined data is shown in table 4-8.

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Prime	1,31	46.646***	2.701	1,23	39.359***	.011
Prime x Verb	1,31	20.194***	.855	1,23	2.211	.008
Verb	1,31	9.681**	.879	1,23	.237	.011

Table 4-8: Statistical results of 2-way ANOVAs on the incorrect passives data, with Prime and Verb as factors and collapsing data across the two L2 groups.

The results reveal a significant main effect of Prime as well as a marginally significant interaction of Prime and Verb (significant in the participants analysis only): participants produced 13% more incorrect passives after Passive primes than after Active primes, and

the priming effect was 6% stronger in the passive same-verb than in the passive different-verb condition. Participants also produced more incorrect passives when the verb was the same compared to when it was different (main effect of Verb, significant in the participants analysis only). However, this is likely to reflect a big lexical boost in the Passive prime conditions, because so few passives were produced in the Active conditions.

As in Experiment 1, the finding of a significant priming effect and lexical boost even when the targets that were variant passives shows the L2 priming cannot be attributed to a simple repetition of the surface form of the prime, but seems to reflect persistence of a more abstract representation of the passive.

4.5.5 The Nature of the Incorrect Passives

As in the previous chapter, I also looked at how the prime condition affected the production of errors: given that a participant produced a passive target, how did the nature of the prime influence whether or not that passive would contain a grammatical error? Table 4-9 shows the number of incorrect passives produced by all the L2 speakers in each condition. In brackets I have shown the proportion this number was of the total passives (correct and incorrect) produced in that condition.

	Active / Same verb	Active / Diff verb	Passive / Same verb	Passive / Diff verb
Number of incorrect inflections	1 (.10)	2 (.12)	25 (.26)	17 (.30)
Number of incorrect auxiliaries	6 (.60)	7 (.41)	14 (.14)	15 (.27)
Number of incorrect prepositions	0 (.00)	3 (.18)	10 (.10)	9 (.16)
TOTAL of incorrect passives	7 (.70)	10 (.59)	41 (.42)	31 (.54)

Table 4-9: The number of incorrect passives produced in each condition by the L2 speakers, grouped by error-type. In brackets is shown what proportion this number is of the total passives produced in that condition (correct and incorrect). NB: The sum of the individual types of errors does not add up to the total number of incorrect passives because several target utterances contained more than one type of error.

The nature of these data makes statistical analysis difficult; however, some general observations can be made. From Table 4-9 it appears that the proportion of total passives

produced incorrectly was not drastically different across the different prime conditions. However, there was a tendency to produce a larger proportion of incorrect targets after an Active prime than after a Passive prime, suggesting that having seen a correct syntactic structure in an immediately preceding sentence did facilitate correct production of a passive in the target. In the Active condition, there was a tendency to produce a higher proportion of incorrect passives when the verb had been the same compared to when it was different. However, this effect emerged mainly in choice of auxiliaries, and it is hard to imagine why a finite active verb form would affect the production of a passive auxiliary form.

Another observation is that following a passive prime, there was a tendency to produce a smaller proportion of incorrect passives when the verb was the same in prime and target compared to when it was different. This suggests that the overlap in functional morphology made L2 speakers more likely to produce correct morphology. The verbal overlap should have had most impact on verbal morphology. However, the difference was not considerable: in the same-verb condition the L2 participants produced 26% of passives with incorrect verbal inflection, compared to 30% incorrect inflections in the different-verb condition.

4.5.6 Relationships between priming and L2 proficiency

As in Experiment 1, the analyses produced few differences between the behaviour of the Intermediate and Advanced L2 groups. The selection process in terms of proficiency had been the same as in Experiment 1; as in Experiment 1, then, the two L2 groups formed more a continuum of proficiency as opposed to two clearly distinct language proficiency groups. I therefore explored correlations between the priming effect displayed by individual participants and their specific level of proficiency. I carried out the same four Spearman's Rho correlation analyses as in Experiment 1 (see section 3.7.4). However, here I performed two-tailed tests, because the predicted relationship between proficiency and priming (L2 priming decreasing with increasing proficiency) had not been found in Experiment 1, and if anything the trend was numerically in the opposite direction.

None of these analyses showed a significant relationship between priming behaviour and proficiency (Same-Verb priming vs. Cloze (see Figure 4-4): $N=32$, $r=.120$,

$p=.512$; Different-Verb priming vs. Cloze (see Figure 4-5): $N=32$, $r= -.149$, $p=.416$; Total priming vs. Cloze (see Figure 4-6): $N=32$, $r=.022$, $p=.904$; Lexical boost: (see Figure 4-7): $N=32$, $r=.187$, $p=.306$).

Hence, we can be confident that there was no developmental trend in L2 priming in the group. Interestingly, the correlation coefficient in each case was positive, showing that, if anything, priming and lexical boost tended to increase with increased proficiency.

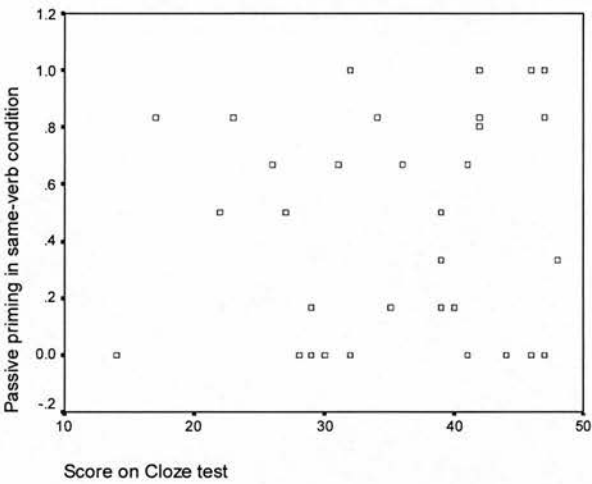


Figure 4-4: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of passive priming seen for that participant in the same-verb condition.

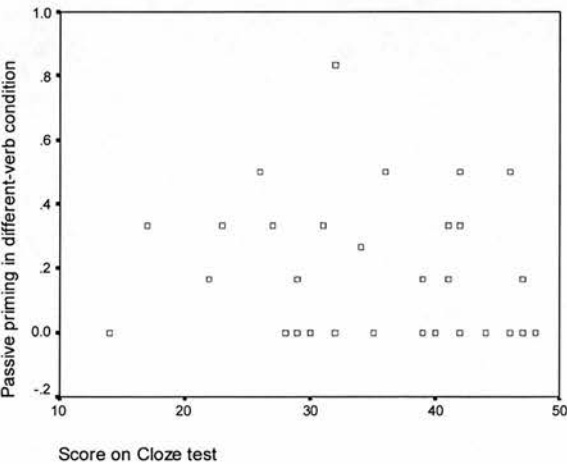


Figure 4-5: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of passive priming seen for that participant in the different-verb condition.

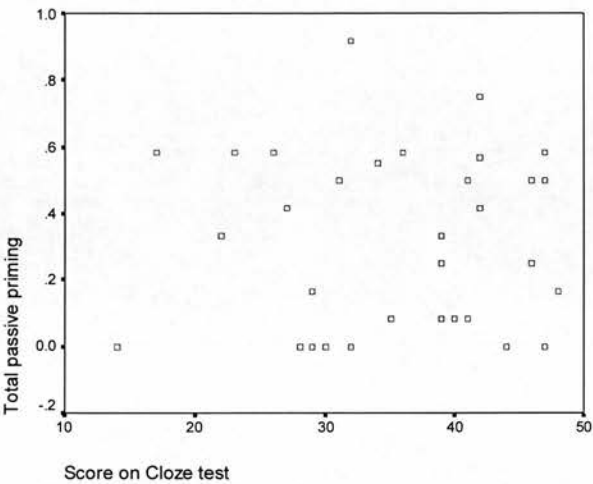


Figure 4-6: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of total passive priming seen for that participant across the whole experiment.

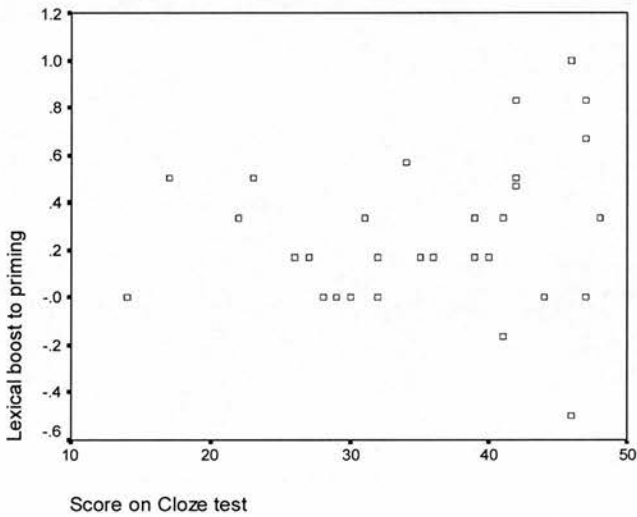


Figure 4-7: A scatter plot showing the relationship for individual L2 participants between their score on the Cloze test and the magnitude of lexical boost to priming seen for that participant across the whole experiment.

4.5.7 The ‘Other’ responses

Finally, I examined the nature of the ‘Other’ responses, to identify any patterns of interest in these constructions. There were 24 ‘Others’ produced across the whole experiment, 2.1% of the total responses. This is comparable to the proportion of Others produced in

Experiment 1 (2.7%). Of these Others, 5 were produced by Advanced L2 speakers, 6 by Intermediate L2 speakers, and 13 by L1 speakers.

The nature of the 'Others' were as follows: 4 were conjunctions (e.g., *El barco y la botella se estan tocando*: 'the boat and the bottle are touching each other'; 1 by Advanced, 3 by L1 speakers), 7 were intransitive sentences (e.g., *el bate se quema*: 'the bat burns'; 3 by Advanced, 2 by Intermediate, 2 by L1 speakers), 2 were OVS structure (e.g., *el fuego se oculta la casa*, the fire, it hides the house: 'The house hides the fire'; both by L1 speakers), and the other 11 were construction in which the patient appeared as the subject and the agent as the object, but not using the *ser* form of the passives (e.g., *el fuego se oculta detras de la casa*: 'the fire is hidden behind the house').

I also considered whether there were effects of primes on the production of Others. As in Experiment 1, I addressed whether passive primes influenced production of OVS targets. There was no evidence in the current study for a passive priming an OVS structure: only two OVS structures were produced, one after an active prime, the other after a passive. However, of the 11 Others which used a patient-subject construction, 7 of them occurred after a passive prime compared to only 4 after an active prime. Although these figures are not large enough to do statistical analysis, this is consistent with comprehension of a passive prime increasing the likelihood of producing a construction that links the patient-role to subject position.

4.6 Comparison of Experiments 1 and 2

Before drawing some general conclusions on the results of Experiment 2, I wanted to directly compare the results of this experiment to those from Experiment 1. Both the experiments used the same materials, and participants drawn from the same populations, but differed in the experimental set-up. Although Experiment 2 suggests strongly that the increased priming for L2 over L1 speakers cannot be attributed wholly to social psychological factors relating to social pressures to conform, we cannot conclude that such factors do not contribute to differences in L1 versus L2 priming. If there is some effect of social pressure, then we would expect to find that L2 priming to be greater in Experiment 1 (where those social psychological factors might play a part) than in Experiment 2, where they did not). I therefore carried out analyses comparing firstly the

L2 data from Experiments 1 and 2, and secondly the L1 data from Experiments 1 and 2. I predicted if there was a social psychological ‘expert’ effect in the dialogue context, priming would be stronger for the L2 speakers in Experiment 2 compared to Experiment 1, but there would be no difference for the L1 speakers across the two Experiments.

4.6.1 Analysis on the L2 speakers

For this comparison I used the lenient-scoring data; because neither Experiment 1 nor Experiment 2 showed significant differences between the Advanced and Intermediate L2 speakers, I collapsed the data from the two groups into a single L2 group. The data for the separate studies can be found in Tables 3-2 and 4-2. However, to aid the interpretation of the analyses, a graph showing the proportions of passives produced in each experiment in each priming condition can be seen in Figure 4-8.

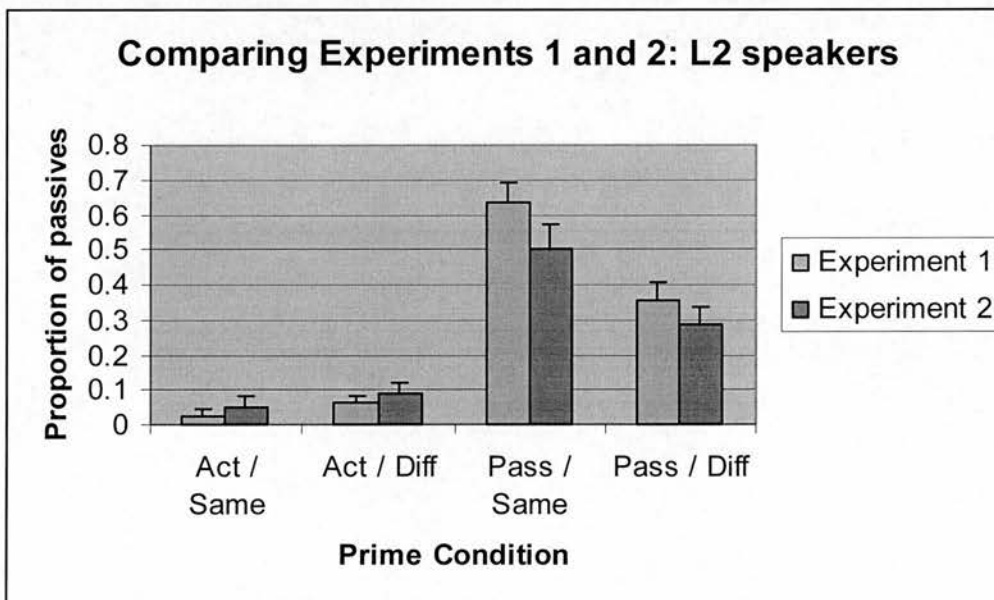


Figure 4.8: The proportion of passives produced by the L2 speakers in Experiments 1 and 2 in each priming condition, as a proportion of the total responses in that condition. The prime conditions were the following: act same (active prime, same verb between prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

I performed three-way ANOVAs on the L2 data from Experiments 1 and 2, with the factors Experiment (Dialogue vs. Computer), Prime (Active vs. Passive), and Verb (Same Verb vs. Different Verb) (note that Experiment was a between-participants and within-

items factor, and Prime and Verb were both within-participants and within-items factors). The statistical outcomes of this analysis can be seen in Table 4-10. There were significant main effects of Prime and Verb, as well as an interaction of Prime and Verb. I will not discuss this given that these results were discussed when analyzing the experiments individually. More interestingly, there was an interaction of Experiment and Prime (marginally significant in the by-participants analysis, but significant in the by-items analysis), reflecting a difference in the priming effect: in Experiment 1 participants produced 45% more passives after a passive prime than after an active; in Experiment 2 this effect reduced to 32%. There was also an effect, significant in the by-items analysis only, of Experiment¹⁹. This reflected that slightly more passives were produced overall in Experiment 1 than 2. No other effects reached significance.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,54	125.124***	.065	1,23	280.941***	.030
Prime x Verb	1,54	58.800***	.019	1,23	48.975***	.022
Verb	1,54	30.954***	.020	1,23	18.548***	.032
Experiment x Prime	1,54	3.273 (p=.076)	.065	1,23	14.576**	.023
Experiment	1,54	.545	.464	1,23	4.351*	.025
Experiment x Verb	1,54	.775	.020	1,23	2.096	.018
Experiment x Prime x Verb	1,54	.427	.019	1,23	1.793	.024

Table 4-10: The statistical results of 3-way ANOVAs on the L2 data, with Experiment, Prime and Verb as factors.

4.6.2 Analysis on the L1 speakers

I then performed identical three-way ANOVAs as described in the section 4.6.1, but on the L1 speakers' data. The data for these analyses can be found in Tables 3-2 and 4-2. However, to aid the reader in interpreting the analyses, a graph showing the proportions of passives produced in each experiment in each priming condition can be seen in Figure 4-9.

¹⁹ These results were significant in the by-items analysis only, but the analysis was across different experiments. Given these conditions, effects are less likely to emerge as significant compared to within-experimental conditions.

The statistical outcomes of these analyses can be seen in Table 4-11. There were significant effects of Prime and Verb, as well as an interaction of Prime and Verb. As with the L2 speakers, this is unsurprising given that these results were found in the individual experiments. However, there no other effects reached significance, indicating similar behaviour by the L1 speakers in both Experiments.

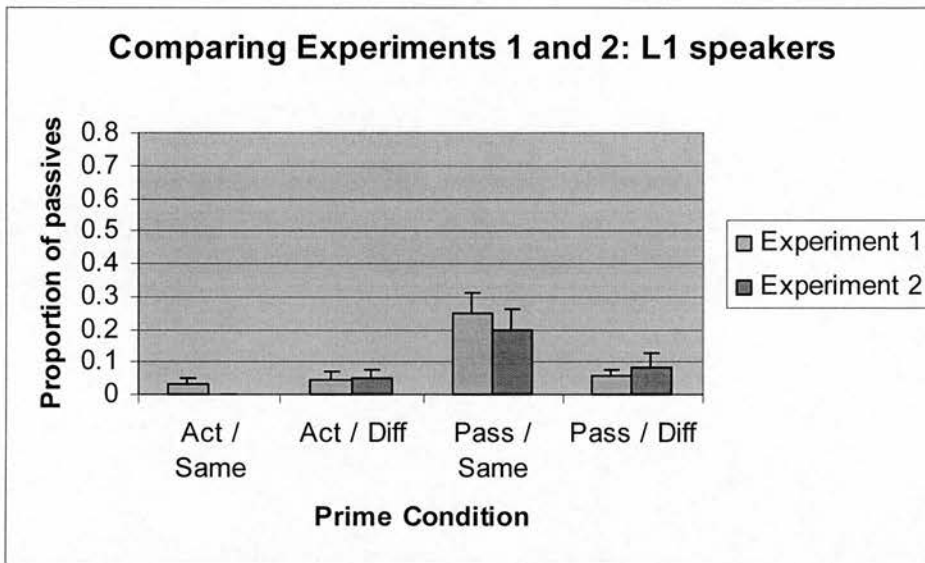


Figure 4-9: The proportion of passives produced by the L1 speakers in Experiments 1 and 2 in each priming condition, as a proportion of the total responses in that condition. The prime conditions were the following: act same (active prime, same verb between prime and target); act diff (active prime, different verb); pass same (passive prime, same verb); pass diff (passive prime, different verb). Bars represent standard error values.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,26	12.901**	.028	1,23	23.925***	.021
Prime x Verb	1,26	20.397***	.012	1,23	25.174***	.013
Verb	1,26	6.463*	.016	1,23	5.858*	.016
Experiment	1,26	.111	.034	1,23	.003	.023
Experiment x Prime	1,26	.000	.028	1,23	.047	.022
Experiment x Verb	1,26	1.525	.016	1,23	3.872 (p=.061)	.019
Experiment x Prime x Verb	1,26	.252	.012	1,23	.335	.033

Table 4-11: The statistical results of 3-way ANOVAs on the L1 data, with Experiment, Prime and Verb as factors.

4.6.3 Summary of Cross-Experiment Comparisons

Experiments 1 and 2 used the same experimental materials, but in different experimental settings, and both produced clear priming effects. For the L1 speakers the priming effects were of the same magnitude in both experiments. However, for the L2 speakers the priming effect appears stronger in Experiment 1, when they were engaging in a dialogue with a native speaker of Spanish, compared to in Experiment 2, when they were interacting with a computer. This result is consistent with the idea that the L2 speakers were influenced by social psychological factors in Experiment 1, specifically the pressure to conform to the language of an ‘expert’. No such effect is seen in the L1 speakers, because there is not the same inequality in terms of expertise in Spanish when both naïve participant and confederate are native speakers of the language.

Of course, there were other key differences between the two experiments other than the presence or absence of a native-speaker. For example, Experiment 1 used dialogue, which is known to produce particularly strong priming effects (e.g., Branigan, Pickering & Cleland, 2000), whereas Experiment 2 was a monologue. In addition, the modality of the prime input was different across the two studies (spoken vs. written). However, such an explanation would predict that both L1 and L2 speakers would show stronger priming in Experiment 1, which was not the case.

4.7 Discussion

One aim of Experiment 2 was to replicate the findings from Experiment 1 that syntactic priming and a lexical boost to priming can be found in L2 speakers. A second aim was to see if the stronger priming in L2 vs. L1 speakers, and the lack of difference across L2 proficiency, would be replicated in the absence of any social interaction with native speakers.

The results of Experiment 2 showed a very similar pattern of effects to Experiment 1, despite important differences in how the primes were presented (text descriptions on a computer screen, rather than spoken descriptions from a co-present native speaker). This replication supports that L2 syntactic priming is a robust effect. Both L1 and L2 speakers of Spanish were more likely to produce a passive construction after processing a passive construction than after processing an active construction; this tendency was stronger for L2 than for L1 speakers. Priming was also stronger when the

verb was repeated across prime and target. Indeed, as in Experiment 1, the L1 speakers did not show any priming in the absence of lexical overlap. However, there was still no significant difference in priming between the Intermediate and Advanced L2 groups, even in correlation analyses comparing individual proficiencies and priming magnitude.

The data suggest that models of L1 processing which are based on similar syntactic priming evidence, such as Pickering & Branigan's (1998) combinatorial nodes model, can be extended to account for L2 processing. The L2 speakers made some mistakes in the surface form of the passives, but priming still persisted in the presence of these mistakes. We can conclude that L2 speakers, at the proficiencies tested, possess combinatorial information for structures in the L2 even if mappings to the surface morphophonology are still being consolidated. Unlike in child L1 learners of a language, this knowledge is abstract and independent of specific lexical items, but still linked to specific lemmas as indicated by the lexical boost to priming.

4.7.1 Dialogue vs. computer interaction

The finding of similar effects in varied social settings shows that priming cannot be explained as simply due to pressure on the L2 speakers to conform to the language structure of the native speaker 'expert'. This is particularly important when interpreting the finding that priming was stronger in the L2 than L1 speakers, because non-native speakers are more likely to feel pressure relating to perceived linguistic expertise than native speaking participants. It could be argued that using a computer to present prime sentences may create additional pressure to conform as there may also be a tendency for people to treat computers as 'experts'. The extent to which this occurs would presumably depend on the amount of experience participants have had with computers, and their beliefs about the source of the written materials. However, the important finding is that the L2 priming generalised across two contrasting social settings. The priming also generalised across prime modality (auditory vs. visual) which indicates that syntactic representations in L2 speakers are shared between modalities, as has been found in L1 speaker priming (both in this experiment, and see Branigan, Pickering, McClean & Cleland, submitted).

A direct comparison of Experiments 1 and 2 supported that social pressure may have played a factor in the degree of syntactic persistence observed in Experiment 1. In the L2 groups, more syntactic repetition was observed when primes were spoken by native speakers of Spanish than when they were presented on a computer. In contrast, the native speaker participants were just as likely to repeat the syntactic structure of a prime when it was produced by a fellow native speaker as when it came from a computer screen. Although there were other differences between the two experiments (e.g., mode of prime input; dialogue vs. monologue), these differences cannot explain why an inter-experimental difference was only seen for the L2 speakers, not the natives. However, the L2 speakers continued to be more susceptible to priming from the syntactic context than L1 speakers, despite the removal of pressure from the presence of a native speaker. In Chapter 5 I further discuss possible causes of this finding, and present an experiment to address this issue directly.

Finally, with respect to methodology, it was important to find similar results using this computerized technique as compared to the dialogue set-up. Having found similar results across the two experiments I was confident to continue with the computerized technique in subsequent experiments and thereby avoid any difficulty of social issues affecting observations of priming.

4.7.2 Absence of a developmental trajectory in L2 Groups

One aim of both Experiments 1 and 2 was to look for any developmental changes in priming, to see whether the pattern of effects would be different for L2 speakers at different levels of proficiency. However, I failed to find any significant differences between the Intermediate and Advanced L2 groups in both experiments.

There are several possible explanations for this lack of differences between groups. For example, the L2 speakers were divided into two groups according to standard assessment tests, but the proficiencies still fell along a continuum. There may therefore not have been enough proficiency distinction between the two to make a clear difference in their linguistic behaviour. However, this explanation seems unlikely as I also failed to find any correlations between priming effects and proficiency. Correlations should be the most sensitive measure of a relationship between priming and proficiency, because L2

speakers were treated individually as opposed to collapsed into broad proficiency groups. The lack of any such correlation suggests that Intermediate and Advanced L2 speakers of Spanish do not differ in their representations and processing of syntactic structures.

Another possible explanation is that I only considered two levels of L2 proficiency, the lowest of which already had an intermediate level of Spanish. I also ensured that all participants were familiar with the passive construction. It is impossible to draw firm conclusions on how L2 development affects priming without looking at learners at more extreme proficiencies, at both the early beginner and ultimate attainment stages of acquisition. For example, if a beginner learner has no experience with a particular syntactic structure then there should be no abstract representation for this structure available in the L2, even if this construction exists in the learner's L1. According to this argument, no priming would be expected initially, although examples of the primed structure could appear over the course of the experiment because the prime constructions offer an opportunity for learning (this fits well with models of language acquisition, in which the process of top-down comprehension of a novel syntactic structure can create a new representation for that structure, e.g., Carroll, 1999; Truscott & Sharwood Smith, 2004). However, there are methodological difficulties with testing syntactic priming in early learners because they are unlikely to have mastered the required vocabulary.

In addition, given that there was a difference in the priming seen in our L1 and advanced L2 groups, the question remains of how end-state 'near-native' speakers pattern. Near-natives are L2 speakers assumed to have attained the highest possible competence in an L2, with linguistic behaviour virtually indistinguishable from a native speaker (e.g., White & Genesee, 1996). In the current study, only 2 of the tested participants would be classified as having reached this stage of development (according to their Cloze score). It would be interesting to test how near-native priming patterns compared to the current data. This would also have implications for how similar syntactic processing in end-state L2 speakers is to native speakers of the same language. There was still a marked difference in behaviour between the L1 and Advanced L2 speakers in this study. If near-native behaviour converges on that of the natives, this would be evidence for the possibility of native-like attainment of syntax; if near-native behaviour continued

to pattern like the advanced group, this would suggest evidence that after a critical period there will always be key differences in syntactic processing across L1 and L2 speakers. However, this is beyond the scope of the current thesis and an idea for future explorations (see Chapter 9).

4.8 Summary

In Chapter 3 I presented evidence that L2 speakers were more susceptible than L1 speakers to syntactic priming from the preceding context, but L2 proficiency did not seem to influence priming magnitude. In the current chapter I explored whether this finding was an artefact of the dialogue task, whether priming magnitude influenced by social pressure to conform to a native interlocutor, which L2 speakers may feel more strongly than L1 speakers. I presented a second experiment which used the same materials and participant pool as in Chapter 3, but without the presence of a native speaker. Instead, primes were presented on a computer screen and targets spoken into a tape recorder.

The results were very similar to those found in Chapter 3: both L1 and L2 speakers of Spanish were more likely to produce a passive target after a passive prime than after an active prime, and this tendency was stronger when the verb was repeated across prime and target. This replication of the results from Experiment 1 further strengthens the reliability of the L2 priming effects and therefore the argument that similar mechanisms and representations underlie L1 and L2 syntactic production.

A comparison between Experiments 1 and 2 showed stronger priming in the L2 speakers in the dialogue context than in the computerised context, but no such difference in the L1 speakers. This supports that there was social pressure enhancing syntactic alignment in Experiment 1. However, priming was still significantly stronger in the L2 speakers compared with the L1 speakers, although the size of the lexical boost was the same in all speakers. There was still no significant effect of L2 proficiency on the pattern of results; the absence of any proficiency effect even when individual speakers' levels of proficiency were taken into consideration suggests strongly that for speakers with this range of proficiency, there is no developmental trend in priming.

In Chapter 5 I will focus on the issue of increased priming magnitude in L2 compared to L1 speakers, discussing possible causes, and present an experiment designed to explore the issue further.

5 Magnitude of Priming in L1 vs. L2 speakers

5.1 Overview

In Chapter 4 we saw further evidence that sentence-level processing in L2 speakers is underlain by similar syntactic representations and processing mechanisms as in L1 speakers. However, I also found important differences between L1 and L2 production, specifically that L2 speakers showed significantly stronger priming than the L1 speakers, who resisted passive priming in the absence of lexical overlap; these effects cannot be attributed wholly to social psychological influences on the L2 speakers.

In this chapter I present a third experiment, which aimed to investigate the source of the different priming magnitudes in L1 and L2 speakers observed in the last two chapters. Firstly, by priming two structures that are both highly acceptable for L1 speakers. Secondly, by comparing learners from two different language backgrounds, to address whether the syntactic structures in an L2 speaker's L1 influenced priming in L2 production.

I begin by discussing some factors that could determine the susceptibility of L1 and L2 speakers to syntactic priming. I then present Experiment 3, designed to address which of these factors affect the magnitude of priming effects. This experiment used the same computerized technique as in Chapter 4. Participants were native speakers of English, and advanced L2 speakers of English for whom the L1 was either Spanish or German. The primes used either a prepositional dative construction (PO; e.g., *the clown sending the letter to the waitress*), a double object (DO; e.g., *the clown sending the waitress the letter*), or an intransitive construction (e.g., *the clown laughing*), which acted as a baseline.

5.2 Introduction

The primary aim of this thesis is to determine to what extent L1 and L2 speakers show similar behaviour in sentence production, reflecting the processes involved in building up words into syntactic structures. Chapters 3 and 4 demonstrated similarities in L1 and L2 syntactic production in that significant priming of the passive construction was observed in Intermediate-Advanced L2 speakers of Spanish as well as in L1 speakers. This effect

was boosted by lexical overlap between the primes and targets, and was found in two different experimental settings. However, L1 and L2 speakers differed significantly in the magnitude of the priming effect; although both groups exhibited reliable priming, both experiments demonstrated significantly stronger effects for the L2 speakers than for the L1 speakers. This contrasts with the magnitude of the lexical boost, where L1 and L2 speakers showed the same magnitude of enhanced priming when the verb was repeated. In the current chapter I focus on possible causes of stronger overall priming in L2 than L1 speakers.

Chapter 3 introduced three psycholinguistic factors that could be responsible for this difference in native and non-native priming magnitude. These factors are frequency of experience with particular structures, knowledge of how preferred or appropriate a structure is in the target language, and influence of an L2 speakers' L1 on the new syntactic system. If a particular factor is found to influence sentence level production, a model of L2 syntactic production must account for how and where this occurs. I discussed these factors in section 3.5.1, but present a brief review here, including predictions which follow from each account. I then present Experiment 3, which was designed to investigate these issues.

5.2.1 Frequency Effects on Syntactic Priming

One explanation for why L2 production might be more susceptible to priming is that L2 syntactic representations are less entrenched in the system (because they have been experienced less frequently) and are therefore more easily influenced by the context. This is based on evidence that less frequent (although not highly infrequent) structures show stronger priming than more common alternatives in the same language. Such a finding is predicted by models that explain priming as the strengthening of message-to-syntax mappings: a less-frequent prime exerts a greater impact on the system than a more frequent one, causing greater learning and so larger priming (Ferreira, 2003a,b). A frequency effect can also be explained by activation accounts of priming, where the role of priming is to boost the activation of a particular node, so making it more likely to reach a threshold level of activation at which it will be selected. For L2 speakers who have less experience with structures in their new language, the resting activation level of

syntactic representations would presumably be lower than in normal L1 speakers, for whom this activation may be at near ceiling-level. Any activation input from a prime will therefore have a strong impact on the L2 system, but a limited effect on representations in L1 speakers

An argument based on frequency and experience would predict a developmental change in priming: stronger priming should be seen in lower- than higher-proficiency L2 speakers, because the former have less experience with the new language and thus presumably lower frequency structures than the latter. However, Experiments 1 and 2 showed no change in priming correlated to proficiency. There was even a numerical tendency for the Advanced L2 speakers to show *more* priming than the lower L2 speakers, and the Advanced L2 priming did not converge with the priming magnitude of the L1 speakers. An experience-based account of the findings also makes the prediction that L2 speakers from different L1 backgrounds should show stronger priming than L1 speakers, irrespective of the characteristics of their L1 and in particular irrespective of whether the alternative structures exist, and if so have the same preferences, in their L1. However, Experiments 1 and 2 only investigated one set of construction alternates, and one combination of L1 and L2. In order to confirm the frequency-based account, the finding should be extended to other languages and constructions. I now turn to consider the choice of structures in the previous experiments, and how this may have affected priming.

5.2.2 Knowledge of constraints on L2 structures

A second factor that could have caused the increased priming effect in L2 speakers compared to L1 speakers might be that L2 speakers have not acquired constraints on usage of particular structures in the target language. Speakers are unlikely to use a particular structure if it is dispreferred or marked, even if it is a grammatical option. As described in Chapter 3, the passive in spoken Spanish, although grammatical, is relatively marked, and Spanish speakers are less willing to use passives than English speakers (Prat Sala, 1997; Prat Sala and Branigan, 2000). Experiments 1 and 2 used the passive *ser* form which is rare and dispreferred in spoken Spanish, and L1 speakers show a distinct preference for other constructions (e.g., Prat Sala, 1997; Stewart, 1999). Because L1

speakers of Spanish find *ser* passives dispreferred to some extent in most spoken contexts, they may show a resistance to producing passives even when primed; previous research has shown that even with the additional boost from priming there may be little production of a rare or marked structure (e.g., Hartsuiker & Kolk, 1998a; Pickering, Branigan & McLean, 2002). In support of this argument, L1 speakers in Experiments 1 and 2 showed no passive priming in the absence of lexical overlap, which suggests some resistance to priming.

As discussed in Chapter 2, L2 speakers often show incomplete mastery of felicity constraints and this leads to them over-using or inappropriately using particular structures (see Sorace, 2003, 2004, 2005). With respect to Experiments 1 and 2, L2 speakers of Spanish whose L1 is English may tend to over-use the passive (Butt & Benjamin, 1994). This tendency might reflect a disproportionate exposure to the structure during instructed learning, combined with incomplete mastery of appropriateness of the passive in Spanish (Butt & Benjamin, 1994). All participants who took part in Experiments 1 and 2 reported having some experience with the passive in Spanish, but without explicit instruction that the structure is rarely used in spoken Spanish.

Hence L2 speakers may show stronger priming than L1 speakers because the native dispreference for passives limits the effect that a prime can yield in L1 speakers, as found in L1 priming studies on other marked structures. If this is the case, the difference in priming between L1 and L2 speakers should reduce when the structures being primed are both felicitous options for the native group. In addition, in contrast to the frequency-based account, this account predicts that L2 speakers may never converge with L1 speakers' behaviour with respect to these constructions, and may persistently over-use inappropriate structural options even at very advanced proficiencies.

5.2.3 Effect of a learner's L1 on L2 Syntax

Finally, the large priming effect in L2 speakers could be attributed to the syntactic characteristics of their L1 influencing processing in the L2. For example, the non-native groups in Experiments 1 and 2 may have transferred the acceptability of the English passive into Spanish, leading to an increased likelihood to produce passives, relative to native speakers. In contrast, if an L2 structure is absent or dispreferred in a learner's L1,

only weak priming of that structure would be expected in the L2 speaker's L1. Thus, if this dispreference is transferred to the L2, resistance to priming might also be expected in the L2.

One means by which this transfer would occur comes from demonstrations of cross-linguistic priming in bilinguals, which are explained as syntactic representations being shared between languages when there is overlap in the surface form of the representations (e.g., Hartsuiker et al., 2004). This offers a simple mechanism for why the preferences of the passive in an English L1 would emerge in the Spanish L2, because the relatively higher acceptability of the passive in English is transferred directly to Spanish.

If this is the case then L2 speakers' susceptibility to priming for a particular structure alternation should be influenced by whether those structures exist in their L1, and if so, whether they have the same preferences. If L2 speakers at matched proficiency levels are primed on a particular structure pair, this predicts weaker priming in learners for whom one alternative does not exist in their L1 than in L2 speakers for whom both structures exist as equally preferred, felicitous options in their L1.

In contrast, if there is no effect of the L2 speakers' L1 preferences on syntactic priming in the target language, we would expect proficiency-matched L2 speakers from different native-language backgrounds to show similar priming effects for particular structures, regardless of whether those structures exist in their L1. Similarly, if the inflated L2 priming is due to incomplete acquisition of the appropriateness of a structure in particular context, this might occur in L2 speakers from any L1 background.

5.3 Summary

We have seen three possible explanations for why the experiments described in the previous chapters produced stronger priming in the L2 than L1 speakers, and the corresponding predictions for priming. Firstly, L2 speakers may be more susceptible to priming *per se*, because they have less experience with the language so their syntactic representations are less entrenched²⁰. This predicts, however, that priming magnitude

²⁰ However, it would still remain the case, even in very advanced L2 speakers, that they have had less exposure to the language than native speakers. It could be argued that under this account too, L2 speakers may never completely converge on native-like behaviour. This question could only be addressed by looking

should decrease with increasing proficiency, which was not observed in Experiments 1 and 2. Secondly, the use of the Spanish passive structure for this priming study may have produced the L1-L2 difference. Passives are a rare option in L1 Spanish, and syntactic priming may not be strong enough to overcome this dispreference. In contrast, L2 speakers of Spanish (English L2) are more willing to use the passive so may produce more passives in general and be more amenable to priming. In support of this, the L2 speakers were more likely to use passives across both Experiments 1 and 2, and the L1 speakers showed no significant priming in the absence of lexical overlap across prime and target, suggesting a resistance to use of the passive in general. A related, third explanation is that if a particular structure exists in the L2 speakers' L1 (as was the case with the passives), there may be transfer of preferences to the new language which may affect how likely L2 speakers are to use particular structures, regardless of their experience with the L2.

Importantly, these possible explanations are not necessarily mutually exclusive. For example, L2 speakers may be more susceptible to priming *per se* than L1 speakers because of less experience with the target language, and thus show stronger priming in all contexts. However, the difference in L1 and L2 priming may decrease when the primed alternatives are both equally preferred for the native speakers group. In addition, there may be an effect of the learners' L1 such that even if L2 speakers show stronger priming than L1 speakers in general, different L1 backgrounds could still cause differential priming effects within L2 speakers. I now present an experiment designed to distinguish between these accounts.

5.4 Experiment 3: dative structure priming in L1 and L2 English

This aim of this experiment was to identify the source of the enhanced L2 priming found in Experiments 1 and 2 by addressing the different issues discussed in section 5.2. I investigated priming for prepositional object (PO; e.g., *the clown sent the letter to the waitress*) and double object (DO; e.g., *the clown sent the waitress the letter*) datives in

at end-state, or near-native, L2 speakers, which is beyond the scope of the current thesis (see Chapter 9 for suggested future research on near-natives).

English. I used three language groups: L1 speakers of English, L2 speakers of English whose L1 was Spanish, and L2 speakers of English whose L1 was German.

This choice of structure alternation and language groups allowed me to explore whether the differences in L1 and L2 priming found in Experiments 1 and 2 reflected inherent differences in processing between L1 and L2 speakers, and whether there is any influence of L1 preferences on priming in an L2.

First, in order to remove any L1 resistance to priming due to dispreference for a primed structure, I chose structural alternatives that were both frequent and acceptable for the L1 speaker group. Previous syntactic priming studies have investigated the PO/DO alternation extensively. Results have shown that both structures are frequent and, more importantly, that both structures yield priming in L1 speakers of English (e.g., Bock, 1986, 1990; Branigan et al., 2000; Pickering & Branigan, 1998). This differs from the Spanish active/passive alternation investigated in Experiments 1 and 2, where the passive was strongly dispreferred by L1 speakers of Spanish (to the extent that no priming was seen in the absence of lexical overlap). We can therefore be confident that any difference in priming for PO and DO structures between the L1 and L2 groups could not be attributed to a strong dispreference for one alternative in the L1 speakers. Hence, any persistent difference in priming between the L1 and L2 speakers would suggest that the differences found in Experiments 1 and 2 reflected a general tendency for L1 speakers to be less susceptible to priming than L2 speakers of a language.

Second, I wanted to look at the effect of the learners' L1 on priming in the L2. I chose L1 speakers of Spanish and German because these languages differ in the overlap between the dative construction options that exist in their L1 and those offered by English with respect to ditransitive constructions. In Spanish, a dative construction must always include a preposition *a* before the recipient NP, although the word order of phrasal constituents is flexible, as shown in (i) and (ii). The DO construction is therefore not a viable option in Spanish, and the default word order is that in (i), with (ii) being quite marked. In contrast, German allows both DO and PO constructions, as well as flexible

word order of constituents, resulting in the possible structures shown in (iii)-(vi), although (iii) is generally the preferred order, and (v) and (vi) are marked structures²¹.

- (i) *El payaso envia la carta a la camarera*
'The clown sends the letter to the waitress'
- (ii) *El payaso envia a la camarera la carta*
'The clown sends to the waitress the letter'
- (iii) *Der Clown schickt den Brief an die Kellnerin*
'The-NOM clown sends the-ACC letter to the-ACC waitress'
- (iv) *Der Clown schickt der Kellnerin den Brief*
'The- NOM clown sends the- DAT waitress the-ACC letter'
- (v) *Der Clown schickt an die Kellnerin den Brief*
'The- NOM clown sends to the-ACC waitress the-ACC letter'
- (vi) *Der Clown schickt den Brief der Kellnerin*
'The- NOM clown sends the-ACC letter the-DAT waitress'

If structural preferences can be transferred from an L1 to an L2, then the L2 groups should differ from each other in their overall behaviour. L2 speakers whose L1 is Spanish, who therefore have the PO but not the DO construction in their L1, should produce fewer DOs in English than L2 speakers whose L1 is German and who therefore have the DO construction as well as the PO construction in their L1²².

²¹ As in English, there are lexical constraints on usage of these constructions which are fairly idiosyncratic. For example the verb *to fine* in English can be used with the DO but not the PO dative (*The policeman fined the driver twenty pounds* vs. **The policeman fined twenty pounds to the driver*). Similarly, the verb *zeigen* ('to show') can be used with the DO but not the PO dative in German (*Er zeigt dem Mann das Buch* vs. **Er zeigt das Buch an den Mann*: 'He shows the man the book' vs. 'He shows the book to the man'). All the verbs chosen for this experiment allowed both the DO and PO constructions in both English and (for the translation equivalent) German, as confirmed by two native German speakers.

²² The prime sentence in Experiment 3 actually omitted the auxiliary verb (e.g., *The teacher showing the doctor the jug*), thus giving a verbal form that does not exist in German. Because the participants generally following this verbal form, the German speakers were producing a verb structure which does not exist in their L1. However, verbal morphology is not thought to be intrinsic to syntactic priming effects, which are thought to be phrasal in nature (Pickering & Branigan, 1998). In addition, the key manipulation of interest was the order and form of the verbal complements and how they differ across languages, and not the verb itself.

More importantly, if L1 structural preferences influence L2 priming, then any tendency for L2 speakers to transfer preferences from their L1 should result in differential priming effects for the two L2 groups. Specifically, L2 speakers whose L1 is German should show equivalent priming to L1 English speakers for both structures, because both structures exist and have roughly the same (i.e., relatively balanced) preference in English and Germans; however, L2 speakers whose L1 is Spanish should resist priming of the DO construction because it does not exist in their L1. If both L2 groups instead show comparable priming for both structures, this would suggest that L2 speakers do not transfer L1 preferences to their L2, and hence that L2 processing is relatively impermeable to influences from the L1.

The participants used were all advanced speakers of L2 English. This was firstly because it was easier to control proficiency across the L2 groups if only very fluent L2 speakers were recruited, and secondly because the difference in priming in Experiments 1 and 2 had been numerically greatest between the L1 and advanced L2 speakers.

In terms of materials, I included a baseline in this study in order to measure default preferences of each speaker group for the two structures, and also to be able to measure bidirectional priming of the two structures. The verb was repeated across prime and target in all the conditions to maximize the chance of finding priming effects and thus being able to comparing priming magnitude across groups (given that in Experiments 1 and 2 no L1 priming was found in the absence of lexical overlap).

5.4.1 Participants

54 participants were paid £5 to take part in the experiment. 18 were native speakers of English, without advanced knowledge of any other languages. The other participants were 18 native speakers of German and 18 native speakers of Spanish, all of whom spoke advanced L2 English (see Table 5-1 for details). I will refer to the groups as English, German and Spanish, depending on their L1.

The L2 speakers' proficiency in English was assessed firstly by asking participants to complete a multiple choice language test. The multiple choice test consisted of 60 questions testing both grammar and vocabulary, obtained from the Basil Paterson Language School in Edinburgh. The language school uses this form to assess

incoming students’ level of English, and reported it as an excellent measure of proficiency. Scores of 50 upwards were scored as advanced.

In addition, I obtained self-rating scores on a scale of 1-10 for Speaking, Listening, Reading and Writing proficiency. I collected these scores because the multiple choice questionnaire I used has not previously be used for research purposes (unlike the Cloze test in Experiments 1 and 2, which has been widely used by L2 researchers), and I thus wanted a second measure of proficiency to compare proficiency of the German and Spanish groups.

Independent-samples t-tests showed no significant differences between the two L2 groups on the following measures: months spent in an English-speaking country, self assessments of ability in English Speaking, Reading, Writing, and Listening, and score on Cloze test (all $df=34$, all $ts<1.3$). However, the Spanish group was significantly older than both the German group ($t(34)=3.9$, $p<.001$) and the English group ($t(34)=5.7$, $p<.001$) (although the German and English groups did not differ from each other, $t = 1.9$). Note however that although there was a consistent age difference between the Spanish group and the other two groups, this difference was small and all participants were in the 18-30 age range. More importantly, the Spanish and German participants were matched on their experience and proficiency in L2 English.

	English	Spanish	German
Age	22 (2.8)	28 (3.6)	23.6 (3.0)
Sex ratio	11F / 7M	9F / 9M	13F / 5M
Total time spent in English-speaking country (months)	n/a	41 (34)	32 (17)
Cloze test score (/60)	n/a	55 (3.0)	56 (3.8)
Self-assessments of English proficiency:			
Speaking	n/a	8.3 (1.1)	8.5 (1.2)
Listening	n/a	8.5 (1.2)	8.9 (1.1)
Reading	n/a	9.2 (1.1)	8.9 (1.1)
Writing	n/a	8.2 (1.2)	8.2 (1.6)

Table 5-1: Participant details for Experiment 3: (mean measures, with standard deviation in brackets).

5.4.2 Materials

Two sets of pictures were constructed similar to those in Experiments 1 and 2, with 24 Matching and 36 Description pictures. Each picture (see Figure 5-1 for an example) depicted a ditransitive action involving an animate giver (e.g., the artist), an inanimate theme (e.g., the banana) and an animate beneficiary (e.g., the burglar). The following ditransitive verbs were used, each appearing six times across the Description pictures and four times across the Matching pictures: *award*, *hand*, *lend*, *sell*, *send* and *throw*. These verbs were selected as translations of German ditransitive verbs that allow both the PO and DO construction. In addition, 12 Matching pictures were constructed depicting a single character performing an intransitive action. The relevant verb was printed in the infinitive form beneath each picture. In half the pictures the beneficiary was on the left of the theme and in half the pictures they were on the right.

For each of the ditransitive Matching pictures a double object and a prepositional object prime sentence were generated, and for the intransitive Matching pictures an intransitive baseline prime sentence was generated. Half the prime sentences matched the Matching cards and half were different in some way (in order to generate 'no' responses in the matching task). For a sixth of the Matching cards, the corresponding sentence used a different giver than that depicted in the picture, another sixth used a different theme, and another sixth a different beneficiary.



Figure 5-1: An example of a ditransitive picture used in Experiment 3.

Each Description picture was paired with one ditransitive Matching picture and sentences using the same verb, and also with one intransitive Matching picture and sentence. For example, the Description card in Figure 5-1 was paired with the sentences (i) to (iii).

- (i) The cowboy selling the apple to the nun (PO)
- (ii) The cowboy selling the nun the apple (DO)
- (iii) The teacher laughing (Intransitive baseline)

Three lists were then constructed, as for Experiments 1 and 2, each comprising of 12 items from each condition (i.e., 12 PO primes, 12 DO primes and 12 Intransitive primes) such that only one version of each Description card-prime sentence pairing appeared in each list.

There were also 108 filler Description pictures and 108 filler Matching pictures and sentences, all depicting mono-transitive actions (e.g., a pirate following a chef). In half of these pictures the object of the verb was animate and in half it was inanimate. In a quarter of the Matching sentences the subject was different to that depicted in the picture and in another quarter the object was different (again, to generate ‘no’ responses).

Randomised lists were prepared as in Experiment 1, containing the 36 experimental item pairs and 108 fillers.

5.4.3 Procedure

The procedure was exactly as in Experiment 2 (see section 4.4.3), except instructions were given to all participants in English and all responses during the experiment were in English. All participants filled out a language-background questionnaire after the experimental session, and L2 participants additionally completed an English proficiency test.

5.4.4 Scoring

Each description of a target picture was scored as being PO, DO or Other. A ditransitive picture description was scored as PO if the (inanimate) patient of the action immediately followed the verb and was followed by the preposition *to* and the (animate) beneficiary of the action; and as DO if the (animate) beneficiary of the action immediately followed the

verb, and was followed by the (inanimate) patient of the action. All other descriptions were scored either as Other (including monotransitive descriptions, compounds and different dative constructions (e.g., *the clown awards the cowboy with the book*). Instances where the participant missed a picture or failed to give a description for any other reason were not included in the Other scoring (this occurred in 0.6% of trials).

5.5 Results

Every participant produced 36 target utterances, twelve in each of the three priming conditions defined by the Prime Construction (PO vs. Intransitive vs. DO) factor. These factors were within participants and items. Participant groups were also entered into the analysis as a between-participants factor (English vs. Spanish vs. German).

The scoring produced a total of 1932 responses, of which 1458 (75.5%) were POs, 423 (21.9%) were DOs and 51 (2.6%) were Others.

I computed a measure designed to determine the relative proportions of PO, DO and Other target responses in each of the priming conditions. This measure was the number of PO, DO or Other responses divided by the sum of all responses in that condition (PO, DO and Other). Table 5-2 shows the proportion of PO and DO targets produced by each of the language groups in each prime condition. Figure 5-2 shows the same data in graphical format.

I began by comparing the proportions of each structure produced after an intransitive prime, in order to assess likelihood of producing structures in the absence of a prime. If the characteristics of L1 structures affect L2 processing, this predicts that the Spanish group will show less priming than the German group for DO but not necessarily for PO structures. I therefore looked at production of each type of structure separately. I then performed separate analyses of variance (ANOVAs) on each of the three response-types (PO, DO and Other), treating participants ($F1$) and items ($F2$) as random effects. I will now discuss each of these analyses in turn.

EXPT 3		PO prime	Intransitive prime	DO prime
ENGLISH	PO target	.95	.79	.58
	DO target	.05	.21	.41
GERMAN	PO target	.94	.78	.54
	DO target	.06	.22	.45
SPANISH	PO target	.90	.73	.58
	DO target	.06	.17	.34

Table 5-2: The proportion of PO and DO targets produced in after each prime condition, as a proportion of total responses.

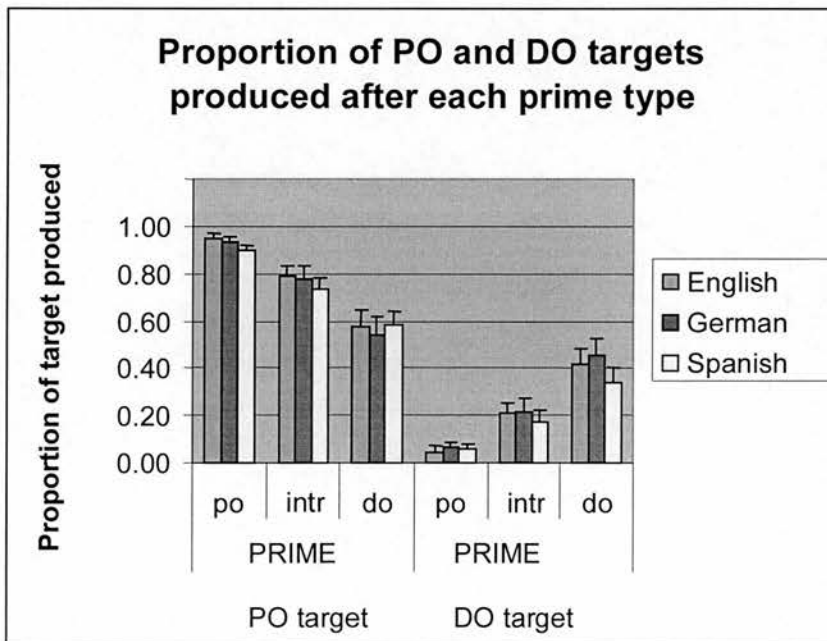


Figure 5-2: The proportion of PO and DO targets produced in Experiment 3 by the three language groups (English, German, and Spanish). The prime conditions were the following: po (prepositional object dative); intr (intransitive baseline); do (double object dative). Bars represent standard error values.

5.5.1 Baseline tendencies

I began by comparing the baseline descriptions in each language group. That is, following a neutral (intransitive) prime, how likely was each native language group to

produce a PO or DO description for the target pictures? Table 5-2 and Figure 5-2 show the proportion of each dative construction produced after Intransitive primes by each language group. I performed pairwise comparisons across each level of Native Language on the proportion of both PO responses and DO responses produced in the baseline condition (independent in the participants analysis and paired in the items analysis). None of these tests produced significant differences between any of the language groups in either the proportion of PO or DO structures produced (all $t_{1s} < .85$; all $t_{2s} < 1.7$). This shows that in the absence of a prime, the English, German and Spanish speakers produced similar proportions of dative structures.

5.5.2 PO Targets

Figure 5-3 shows the proportions of PO targets produced by each of the language groups in each of the prime conditions. See Table 5-2 above for these proportions in numerical format.

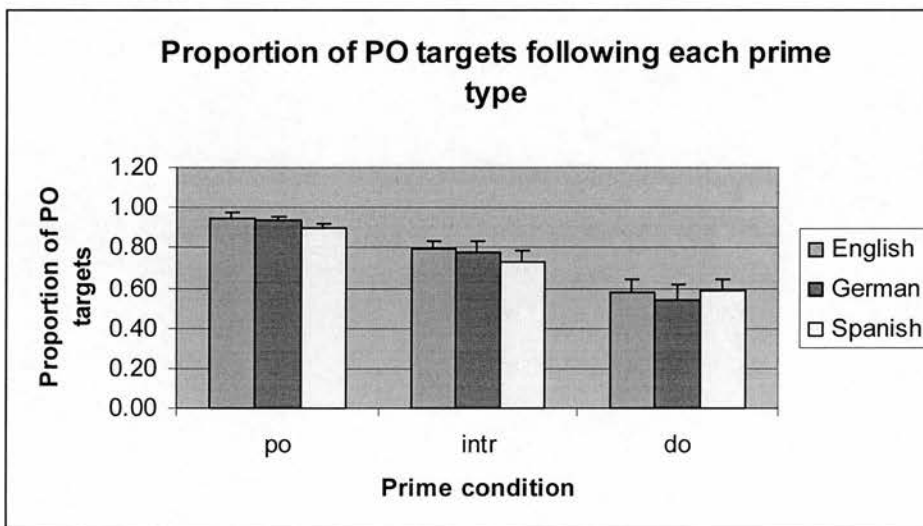


Figure 5-3: The proportion of PO targets produced in Experiment 3 by the three language groups (English, German, and Spanish). The prime conditions were the following: po (prepositional object dative); intr (intransitive baseline); do (double object dative). Bars represent standard error values.

I performed two-way ANOVAs with the factors Native Language (English vs. German vs. Spanish) and Prime (PO vs. DO vs. Intransitive) on the proportions of PO responses produced in each priming condition (Native Language was a between-participants and

within-items factor for the items analysis, Prime was a within-participants and within-items factor). See Table 5-4 for the statistical outcome of these analyses.

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Native Language	2,51	.189	.089	2,70	.599	.020
Prime x Native Language	4,102	.450	.024	4,140	1.540	.027
Prime	2,102	72.523***	.024	2,70	120.592***	.028

Table 5-4: Statistical results of 2-way ANOVAs on the PO targets produced in Experiment 3, with Native Language and Prime as factors.

As can be seen from Table 5-4, there was no main effect of Native Language: all three of the language groups produced similar proportions of PO constructions across the experiment (77% in English speakers, 75% in German speakers, 74% in Spanish speakers). There was, however, a difference in the proportion of PO targets produced in each Prime condition, as reflected by a main effect of Prime. Planned comparisons across the different levels of the Prime factor showed a significant priming effect overall: compared to after an Intransitive baseline, participants produced 16% more PO targets after a PO prime ($t(53) = 6.8, p < .001$; $t(35) = 6.7, p < .001$) and 20% fewer PO targets after a DO prime ($t(53) = 6.8, p < .001$; $t(35) = 7.1, p < .001$). Importantly, there was also no interaction between Prime and Native Language, suggesting that the priming effect did not differ across language groups.

To ensure that the PO priming effect was significant for each language group, I also performed planned comparison on the PO priming for each level of Native Language – comparing the proportion of POs after a PO prime with the proportion of POs after an Intransitive prime. The results confirmed a significant priming effect for each of the three groups. Compared to the Intransitive baseline, English participants produced 16% more PO targets after a PO prime ($t(17) = 4.8, p < .001$; $t(35) = 4.6, p < .001$) and 21% fewer PO targets after a DO prime ($t(17) = 3.9, p < .005$; $t(35) = 4.3, p < .001$). Compared to the Intransitive baseline, German participants produced 16% more PO targets after a PO prime ($t(17) = 3.1, p < .01$; $t(35) = 5.2, p < .001$) and 24% fewer PO targets after a DO prime ($t(17) = 5.1, p < .001$; $t(35) = 6.3, p < .001$). Compared to the Intransitive baseline, Spanish participants produced 17% more PO targets after a PO prime ($t(17) = 4.1,$

$p < .001$; $t_2(35) = 3.5$, $p < .01$) and 15% fewer PO targets after a DO prime ($t_1(17) = 2.8$, $p < .01$; $t_2(35) = 3.0$, $p < .01$).

5.5.3 DO Targets

Figure 5-4 shows the proportions of DO targets produced by each of the language groups in each of the prime conditions. See Table 5-2 above for these proportions in numerical format.

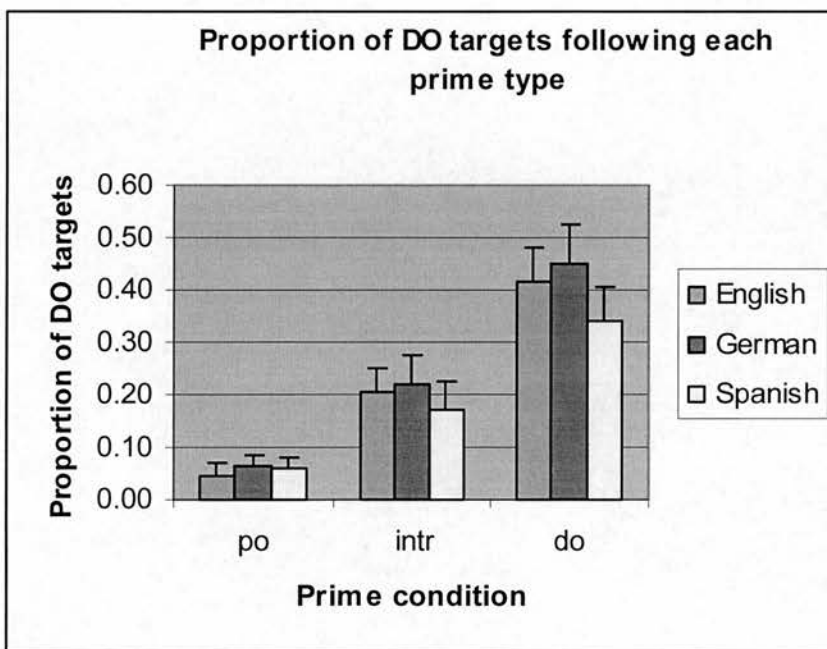


Figure 5-4: The proportion of DO targets produced in Experiment 3 by the three languages groups (English, German, and Spanish). The prime conditions were the following: po (prepositional object dative); intr (intransitive baseline); do (double object dative). Bars represent standard error values.

I then performed two-way ANOVAs with the factors Native Language (English vs. German vs. Spanish) and Prime (PO vs. DO vs. Intransitive) on the proportions of DO responses produced in each priming condition (Native Language was a between-participants and within-items factor for the items analysis, Prime was a within-participants and within-items factor). See Table 5-5 for the statistical outcome of this analysis.

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Native Language	2,51	.417	.095	2,70	10.169***	.018
Prime	2,102	65.959***	.025	2,70	116.067***	.022
Prime x Native Language	4,102	.608	.025	4,140	2.514*	.026

Table 5-5: Statistical results of 2-way ANOVAs on the DO targets produced in Experiment 3, with Native Language and Prime as factors.

There was a suggestion of a main effect of Native Language, but this was significant in the by-items analysis only, and most likely due to the Spanish group producing fewer DOs overall (19%) than the German (24%) and English (22%) groups. There was a reliable main effect of Prime type on production of DOs. Planned comparisons showed that compared to the Intransitive baseline, participants produced 20% more DO targets after a DO prime ($t(53) = 7.0, p < .001$; $t(35) = 8.7, p < .001$) and 14% fewer DO targets after a PO prime ($t(53) = 5.9, p < .001$; $t(35) = 7.4, p < .001$). There was a slight interaction between Prime and Native Language, but this was only significant in the by-items analysis. We cannot therefore conclude that the priming effect differed between language groups. I explored this interaction further with respect to the prediction that Spanish speakers might show stronger DO priming than Germans and English speakers. I therefore performed planned comparisons on the DO priming effect (proportion of DO structures produced after DO prime compared to baseline) across the three language groups (independent in the participants analysis, paired in the items analysis). None of these comparisons approached significance. (English vs. German: $ts < .75$; English vs. Spanish: $ts < 1.3$; Spanish vs. German: $ts < 1.7$).

I also examined whether the DO priming effect held for each language group. For each Native Language group I performed planned comparisons of the proportion of DOs after a DO prime compared to after the Intransitive baseline, and also compared the baseline DOs with the proportion of DOs after a PO prime. The results confirmed a significant priming effect in all three language groups. Compared to the Intransitive

baseline, English participants produced 21% more DO targets after a DO prime ($t1(17) = 6.8, p < .001$; $t2(35) = 4.4, p < .001$) and 16% fewer DO targets after a PO prime ($t1(17) = 4.6, p < .001$; $t2(35) = 4.8, p < .001$). Compared to the Intransitive baseline, German participants produced 23% more DO targets after a DO prime ($t1(17) = 4.8, p < .01$; $t2(35) = 5.8, p < .001$) and 15% fewer DO targets after a PO prime ($t1(17) = 3.1, p < .01$; $t2(35) = 5.2, p < .001$). Compared to the Intransitive baseline, Spanish participants produced 17% more DO targets after a DO prime ($t1(17) = 3.4, p < .01$; $t2(35) = 4.0, p < .001$) and 11% fewer DO targets after a PO prime ($t1(17) = 2.8, p < .05$; $t2(35) = 3.3, p < .01$).

5.5.4 Other Responses

I also looked at the nature of the Other responses produced in the experiment. The three language groups did not differ in the proportion of PO responses produced, but a slight effect of Native Language in the DO-targets analysis implied that the Spanish speakers produced more Other responses than the German and English groups. Table 5-6 shows the proportions of Other response produced by each of the language groups in each of the prime conditions. Figure 5-5 shows the same figures in graphical format.

EXPT 3	PO prime	Intransitive prime	DO prime
L1	1 (.00)	1 (.00)	2 (.01)
L2 (German L1)	0 (.00)	0 (.00)	2 (.01)
L2 (Spanish L1)	9 (.04)	19 (.09)	16 (.08)

Table 5-6: Number of Other targets produced in each prime condition; in brackets is this figure as a proportion of total responses by that participant group in that prime condition

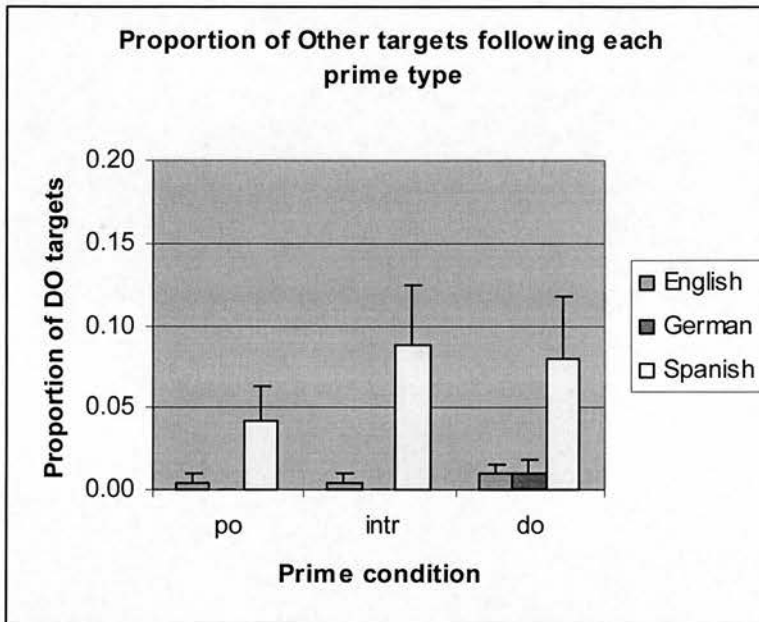


Figure 5-5: The proportion of Other targets produced in Experiment 3 by the three languages (English, German, and Spanish). The prime conditions were the following: po (prepositional object dative); intr (intransitive baseline); do (double object dative). Bars represent standard error values.

I performed two-way ANOVAs on the proportions of Other constructions produced in each priming condition, with the factors Native Language (English vs. German vs. Spanish) and Prime (PO vs. DO vs. Intransitive) (Native Language was a between-participants and within-items factor for the items analysis, Prime was a within-subjects and within-items factor). The results of these analyses can be seen in Table 5-7.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Native Language	2,51	4.590*	.017	2,70	37.257***	.004
Prime	2,102	2.342 (p=.10)	.002	2,70	2.533 (p=.087)	.003
Prime x Native Language	4,102	1.635	.002	4,140	1.187	.005

Table 5-7: Statistical results of 2-way ANOVAs on the Other targets produced in Experiment 3, with Native Language and Prime as factors.

There was an effect of Native Language, and from Figure 5-5 it is clear this reflects that the Spanish group produced more Other responses overall (7%) than the other two groups. Planned comparisons showed that the Spanish group produced significantly more

Other responses than both the German (0.3%) ($t_1(34) = 2.2, p < .05$; $t_2(35) = 6.1, p < .001$) and the English (0.6%) speaker groups ($t_1(34) = 2.1, p < .05$; $t_2(35) = 6.5, p < .001$), but that the German and English groups did not differ from each other ($t_1(34) = .5, p = .592$; $t_2(35) = .572, p = .571$).

There was a small numerical effect of Prime on the number of Other responses produced. Participants produced 1.5% Others after a PO prime, 3% Others in the baseline condition, and 3% Others after a DO prime. Although this did not reach significance, the graph in Figure 5-5 suggests a tendency in the Spanish speakers to produce fewer Other responses in the PO condition than in the other conditions. Because the Spanish speakers do not have the DO in their native language, they may be more likely to use an alternative construction when faced with an intransitive or DO prime than the other speaker groups. Finally, there was no interaction of Prime and Native Language. However, we cannot draw any strong conclusions without statistical tests.

Given the significant difference in the number of Others in the Spanish group compared to the German and English group, I was keen to explore the nature of the Other responses, to determine if there were any pattern in the Spanish L2 speakers.

The English group produced 4 Others. 1 of these was a monotransitive utterance. The other 3 occurred when participants used the verb *award* with the preposition *with* instead of *to* (e.g., *the cook is awarding the waitress with the jug*). In terms of phrasal structure, this is a PO, but has the same order of thematic roles as a DO. However, the use of this structure was not influenced by prime type because each of the 3 utterances was produced following a different prime type. Of the 2 Others produced by the German group, one description was monotransitive, the other was a passive construction (*the gun is being thrown over the monk to the clown*).

The Spanish group produced 44 Other descriptions. Of these 44, 14 descriptions were monotransitive (e.g., *the artist selling the book*); 10 descriptions used the preposition *with* in a construction with the verb *award* instead of *to* (as in previous paragraph). More interestingly, the other 20 Other descriptions were ungrammatical structures in English, in which a participant produced a theme-goal word order (as in a PO) but without a preposition, as in *the artist selling the book the swimmer*. However, 17 of these utterances were from a single participant, suggesting that he had little experience

with the DO configuration and was confusing it as meaning that the preposition can be freely dropped from a dative construction.

5.5.5 Summary of Results

Experiment 3 investigated dative priming in L1 speakers of English and advanced L2 speakers of English for whom the L1 was Spanish or German. In a baseline condition the proportion of different constructions produced by each group did not differ, suggesting that preferences for English PO and DO structures did not differ across language groups. In addition, the results showed bidirectional priming of both dative constructions in all three groups: compared to a baseline, all participant groups were more likely to produce a PO construction after a PO prime, and more likely to produce a DO construction after a DO prime. The magnitude of PO priming was the same for all groups. The amount of DO priming was also similar in all three language groups; although there was a small numerical tendency for the Spanish speakers to display less priming for DOs, this tendency did not approach significance in the participants analysis.

An exploration of the Other targets showed native speakers of Spanish to produce more non-DO or PO targets than either the German or English groups, especially after an intransitive or DO prime. The larger proportion of Others may reflect an influence of the L1, in that Spanish does not allow the DO option so are more likely to use an alternative structure, such as *the cook is awarding the waitress with the jug*. Alternatively, it could be that a subset of the Spanish group were not as proficient as the German group in their L2 English, and therefore behaved less like the English speakers. Although the proficiency tests did not suggest a significant difference, about half the Others were produced by 3 participant using ungrammatical sentences with DO phrasal order but with the direct and indirect objects in reverse order (e.g., *the artist selling the book the swimmer*). This is likely to reflect incomplete acquisition of the DO structure by these participants.

5.6 Discussion

Experiment 3 investigated priming of English prepositional object and double object datives in L1 speakers of English and advanced L2 speakers of English whose L1 was German or Spanish.

Experiments 1 and 2 produced significantly stronger priming in L2 vs. L1 speakers, suggesting a difference in the processes underlying syntactic production in native and non-native speakers. In the introduction to this chapter I considered possible explanations for this finding. Firstly, L2 speakers may be more susceptible to priming in general, because of less entrenched syntactic knowledge compared to L1 speakers due to less experience with the language. Secondly, L2 speakers may possess incomplete knowledge about the appropriateness of, or constraints on, the use of syntactic structures in the target language, leaving them more susceptible to priming of structures which L1 speakers disprefer. Thirdly, syntactic characteristics of the L2 speakers' L1 may influence syntactic production in the new language.

The aim of Experiment 3 was to help distinguish between these explanations by controlling for relevant factors. Firstly, I used the PO and DO dative alternation, which is known to be high-frequency and susceptible to priming in L1 speakers of English. Secondly, I used L2 speakers from two different language backgrounds: Spanish, which only allows a PO construction, and German, which allows both PO and DO constructions. If a difference in priming magnitude still emerged between L1 and L2 speakers this would be evidence for non-native syntactic production being more susceptible to influence from the context *per se*. I will now discuss the results of Experiment 3, and associated implications.

Experiment 3 included a baseline condition, enabling a measure of participants' natural tendencies to use the dative alternatives in the absence of primes. The lack of a baseline in Experiments 1 and 2 made it difficult to determine absolute priming magnitudes, allowing only a comparison of the effect of an active prime with the effect of a passive prime. Interestingly, in Experiment 3, behaviour in the baseline condition was

the same across all language groups. This suggests that in unprimed speech the L1 and L2 groups would produce similar proportions of difference constructions²³.

I found bidirectional priming of both PO and DO structures in all three language groups. Participants were more likely to use a DO construction after a DO prime than after a baseline intransitive and more likely to use a PO construction after a PO prime than after a baseline intransitive. The proportion of PO structures produced by the native speakers of English in the baseline condition was higher than has been found in previous studies (77%, in contrast to, e.g., 55% average POs in Branigan et al., 2000). This may be explained by the layout of the pictures, which presented a linear order of giver, then theme, then beneficiary from left-to-right or right-to-left (depending on the orientation of the picture). In the debriefing session, several participants commented that it was easier to describe the picture in a linear order of giver-theme-beneficiary, leading to a higher tendency to produce a PO structure. The only difference seen across groups was that overall the Spanish participants were more likely than the German and English groups to produce Other targets, and slightly less likely to produce DO structures. This is partly due to ungrammatical utterances produced by some participants, suggesting they have not having fully acquired the DO structure (producing theme-goal order, but without a preposition). It could also indicate that although L1-Spanish speakers can acquire the DO, they retain a higher tendency to select alternatives structure than speakers who have acquired the DO at a younger age.

One interesting implication of these results is that L2 priming can occur for a structure which does not exist in a learner's L1: the Spanish group showed significant DO priming despite their L1 not allowing the DO construction. I anticipated such a result, on the basis of the finding that adult speakers show priming for a newly-acquired construction in their native language (Kaschak & Glenberg, 2004). This suggests that new syntactic representations can be formed in adult L2 speakers, even when there is no opportunity for transfer from the L1, and these representations are then processed in a

²³ This finding may not reflect 'normal' unprimed conditions of production, however, because the baseline condition was interspersed with prime structures. Previous studies have found baseline preferences change over the course of a priming study, and attributed this to exposure to the target structures in the experiment (e.g., Hartsuiker & Kolk, 1998a; Hartsuiker, Kolk & Huiskamp, 1999; Hartsuiker & Westenberg, 2000).

similar way to representations in L1 speakers who have acquired this structure in childhood.

I now consider the magnitude of priming found in this study across the three language groups. In contrast to the findings of Experiments 1 and 2, I found no differences in the magnitude of priming between L1 and L2 speakers: L1 speakers of English were just as likely as L2 speakers of English to repeat a primed PO or DO structure. This is particularly striking because the experiment used advanced-proficiency L2 speakers, which were the manipulations yielding the largest difference between L1 and L2 speakers in Experiments 1 and 2.

These results suggest that there is no inherent difference in L1 and L2 speakers' susceptibility to priming, but that priming magnitude depends on the context. When both alternative structures are acceptable to native speakers – that is, when neither structure is strongly dispreferred or has restrictive conditions on its felicitous use – L1 speakers can be primed as strongly as L2 speakers. I can therefore reject the hypothesis that L2 speakers should show stronger priming because of L2 syntactic representations being less entrenched (and so 'less-frequent') than in L1 speakers. Any account of priming magnitude based on frequency would predict that L2 speakers would always display stronger priming than L1 speakers. But in Experiment 3, I found no difference in the magnitude of priming between L1 and L2 speakers (both L1-Spanish and L1-German). Furthermore, as mentioned previously, if the magnitude of priming were inversely proportional to language experience this would predict differences in priming for L2 speakers as a function of proficiency. No evidence for this was found in Experiments 1 and 2.

In addition, there is little support for the hypothesis that learners transfer preferences from their L1 to the new language, at least at the higher-proficiency levels tested here. Experiment 3 produced similar magnitudes of priming in L2 groups from two different L1 backgrounds. In Spanish, only the PO, and not the DO, structure is a viable linguistic option. In contrast, in German both structures are available, and if anything, the DO is generally the preferred option. If L2 learners simply transferred preferences for particular structures from their L1 to processing in the new language where possible, then we would have expected differences in the DO/PO priming patterns in L2 English

speakers from Spanish and German backgrounds. Specifically, Spanish speakers should have resisted DO usage even in primed conditions, because it was not available in their L1 and so was a dispreferred option²⁴. This was not the case. Spanish-L1 speakers showed reliable priming for DO structures, and although the DO priming effect in these speakers was numerically slightly smaller than in the English and German groups, this difference was non-significant in the participants analysis. Hence we can conclude that the Spanish-L1 speakers had acquired syntactic representations for a structure that did not exist in their native language, and that processing of this structure proceeded in essentially the same way as when the structures existed in both their L1 and L2 languages.

The evidence does, however, suggest that in some circumstances L2 speakers show stronger priming than L1 speakers due to incomplete L2 acquisition of the preferences or appropriateness of a construction. In Experiments 1 and 2, the L2 speakers produced a larger proportion of passive responses overall than the L1 speakers, suggesting that the L2 speakers had a stronger preference for this structure than the L1 speakers. This supports previous findings that L1 Spanish speakers disprefer the *ser* passive as a construction. In addition, the L1 Spanish speakers in these experiments showed no priming of the passive in conditions of no lexical overlap, suggesting a resistance to using the passive even under priming conditions. In contrast, Experiment 3 showed that L1 speakers display equally strong priming effects as L2 speakers when both alternatives are high frequency and neither is subject to strong constraints in the L1. Bidirectional monolingual priming is well established for dative structures (e.g., Pickering & Branigan, 1998), and was replicated in the L1 English group here. Importantly, the baseline production of POs and DOs, was equivalent in the L1 and L2 speakers tested, suggesting equivalent preferences for the structures in all three language groups. A logical conclusion is that the key difference between Experiments 1 and 2 compared to Experiment 3 was the relative acceptability of the two structures for the L1 group.

²⁴ Note that these results also rule out an alternative argument in which L2 speakers might show strong priming for structures which do not exist in their L1, because these would be even less entrenched than new L2 structures which do have an analogue in their native language.

Such an explanation fits well with off-line studies on L2 optionality, as discussed in Chapter 2, which show L2 speakers have difficulty in acquiring when it is felicitous or appropriate to use particular syntactic options in the target language: even at very advanced proficiency levels, L2 speakers are seen to treat two syntactic alternatives as being suitable for a particular context, where native speakers have a clear preference for one option (e.g., Sorace, 2005). In this case, English speakers treat passives in their L2 Spanish as more appropriate than L1 Spanish speakers.

Overall, the results from Experiment 3 suggest that the status of structures in an L2 speaker's L1 does not play an important role in determining the presence or absence, and magnitude, of L2 priming. The two L2 groups in Experiment 3 had equivalent experience in English in terms of level of proficiency, age of initial acquisition, and time spent in Britain, so it seems fair to assume that they had had similar exposure to English. Hence the comparable magnitude of priming for L2 speakers irrespective of whether one of the alternative structures existed or did not exist in their L1 suggests preferences are not transferred from their L1 to their L2. It does not seem likely that differences between L2 speakers from different L1 backgrounds would be found at lower proficiencies than the advanced speakers tested here, as no developmental trend in priming was found in Experiments 1 and 2.

Hence, the most likely explanation for the increased L2 priming in Experiments 1 and 2 is that the L1 speakers of Spanish in those experiments resisted priming of the passive because it is a highly dispreferred structure in Spanish. If a structure is highly dispreferred or can only be used felicitously in restricted contexts, then even the increase in activation conferred by priming may be insufficient to make it a competitor for subsequent use.

5.7 Summary

In summary, the aim of this chapter was to explore possible explanations for the finding of stronger priming in L2 speakers than L1 speakers in Spanish (Experiments 1 and 2), and to distinguish between these explanations experimentally.

Experiment 3 demonstrated bidirectional priming in L1 speakers of English and advanced L2 speakers of English (L1 Spanish or German) for PO and DO dative

construction, which are both frequent and felicitous options for L1 speakers. There were no reliable differences in the pattern or magnitude of priming effects across the three language groups. I therefore rejected an account which predicts stronger priming in L2 speakers because their syntactic representations are less entrenched than in L1 speakers, and so more susceptible to influence from the previous context. I also concluded that syntactic options in an L2 speaker's L1 do not greatly influence syntactic processing in the new language. This is because no reliable differences in priming were found between German and Spanish L1 speakers in L2 English, despite the fact that German allows both the DO and PO constructions whereas Spanish allows only the PO construction.

I conclude that the main reason for the differential L1-L2 priming found in the Experiments 1 and 2 was the choice of structures in the study. L1 Spanish speakers appear to resist priming of the passive because it is a highly dispreferred option. To achieve native-like speech in an L2, learners must acquire the appropriateness of syntactic options in the new language. Previous studies on L2 acquisition have concluded this is a particularly difficult (perhaps impossible) task for adult L2 speakers. The present findings support this claim: I propose that L2 speakers are insensitive to the dispreferences for, or constraints on, particular structures in the new language, leaving them more susceptible than L1 speakers to influence from syntactic priming in contexts where one alternative is strongly dispreferred.

In the following chapters I further compare preferences for syntactic structures in L1 and L2 speakers. More specifically, the lexical head of a construction can also place constraints on how acceptable a particular syntactic option is for that context. I therefore address lexical constraints on syntactic production, and explore the association between syntactic options and lexical representations.

6 Lexical constraints on syntactic production in Spanish

6.1 Overview

Chapters 3-5 explored syntactic production in L2 speakers across a variety of structures, proficiencies and L1 backgrounds. The results showed broadly similar effects in L1 and L2 speakers in syntactic priming studies. I concluded that models of syntactic production in L1 speakers based on priming results (e.g., Pickering & Branigan, 1998) can also be applied to L2 speakers.

The structures studied in Chapters 3-5 differed from each other in terms of the assignment of grammatical roles and associated hierarchical structures. They are therefore informative about the functional stage of processing assumed in L1 models of production, where grammatical roles are assigned. But models of L1 processing also assume a second stage of syntactic processing, during which word order is specified. A primary aim of the current and subsequent chapters is therefore to address production of linear word order, to assess how similar positional processing is in native and non-native speakers. This will be done using intransitive verbs in Spanish.

A secondary focus of this chapter is to explore how lexical semantic factors influence structural processing, and how this might differ across L1 and L2 speakers. Word order preferences in L1 Spanish are determined partly by the specific properties of the verb involved. However, this constitutes an ‘interface’ process, in which syntactic and lexico-semantic information must be integrated in order to produce the appropriate syntactic structure. L2 speakers are known to have trouble acquiring these interface constraints, resulting in optionality. I therefore anticipated differences in the way L1 and L2 speakers of Spanish process word order with respect to individual lexical items.

I begin this chapter by summarising the background for word order preferences in native and non-native Spanish, and how this relates to intransitive verbs. I then present an off-line experiment which assessed word order preferences in L1 and L2 Spanish.

6.2 Introduction

To reiterate, the aim of this thesis is to investigate whether syntactic production in L2 speakers is underlain by similar architectures and mechanisms as in L1 speakers. As

discussed in Chapter 2, traditional psycholinguistic models of language production assume two separate stages in constructing the final constituent structure. Firstly, during functional processing individual lemmas are retrieved and assigned functional roles (e.g., subject-nominative, object-dative). This will, to a large extent, also determine the hierarchical-phrasal aspects of the final structure. Secondly, during positional processing an ordered constituent structure is assembled, and linear word order is fixed.

Chapters 3-5 examined how L1 and L2 speakers choose between structures that differ from each other functionally. For example, actives and passives differ in terms of grammatical role assignment (in actives, the agent maps onto the subject and the patient onto the object; in passives this assignment is reversed) as well as hierarchical structure ([NP [VP NP]] and [NP [VP PP]] respectively). In this chapter and those that follow I consider positional processing in L1 and L2 speakers by looking at structures that keep functional aspects constant, changing only linear order of constituents.

The specific word order options I explore are the choice between a pre- and postverbal subject in L1 and L2 Spanish. As discussed in Chapter 2, the appropriate word order in Spanish is determined by a combination of factors, including the class of intransitive verb involved. This constitutes what has been termed an interface, where syntactic information must be integrated (or 'interface' with) lexico-semantic or pragmatic conditions to produce a felicitous structure. L2 speakers are known to have difficulty with acquiring and applying interface constraints on structural processing. This therefore offers an interesting context in which to explore differences in L1 and L2 processing.

To summarise, in this chapter and those that follow I address two more issues about syntactic processing in L1 and L2 speakers. Firstly, is linear word order specified in the same way in L1 and L2 speakers, and secondly, how does word order choice interface with lexical semantic properties of verbs to influence word order production in L1 and L2 speakers? In the next section I review how word order preferences in L1 Spanish speakers are influenced by the properties of intransitive verbs, as well as reviewing evidence that L2 speakers have trouble in acquiring these lexical constraints on word order. I then present an experiment which used a rating task to confirm word order preferences in L1 and L2 speakers of Spanish.

6.3 Split intransitivity and word order in L1 and L2 Spanish

As discussed in Chapter 2, intransitive verbs are often divided into two classes, unergatives and unaccusatives. Semantically, unergative verbs (e.g., shout) tend to denote agentive, atelic actions, while unaccusative verbs (e.g., arrive) tend to denote non-agentive, telic actions. Syntactically, the argument of unergatives is assumed to be base-generated in subject position, but the argument of unaccusatives is assumed to be base-generated in object position, resulting in a postverbal order being more acceptable with unaccusatives. There are also a range of cross-linguistic syntactic correlates associated with the two verb classes.

In this study, the relevant syntactic correlate of these verbs is how they associate with different word order preferences in Spanish. I discussed in the literature review how, in a neutral ‘out of the blue’ context, the answer to a non-focused question like ‘what happened?’ requires unergative verbs to be used in subject-verb (SV) order (as in sentence (i) below); verb-subject (VS) word order, as in (ii), is considered infelicitous. In contrast, if the answer uses an unaccusative verb the single argument is more acceptable with VS order, as in (iii), and SV order sounds anomalous, as in (iv).

- | | | |
|-------|--------------------------|----------------------|
| (i) | <i>El médico gritó</i> | ‘The doctor shouted’ |
| (ii) | <i>??Gritó el medico</i> | ‘Shouted the doctor’ |
| (iii) | <i>Llegó el medico</i> | ‘Arrived the doctor’ |
| (iv) | <i>??El médico llegó</i> | ‘The doctor arrived’ |

There is debate within the literature as to whether the distinction between the verbs is essentially semantic (e.g., Dowty, 1991; Van Valin, 1990) or syntactic (e.g., Burzio, 1986), or a combination of the two (e.g., Levin and Rappaport Hovav, 1995). The debate is not important for the purposes of the current study: the important factor is that lexical characteristics influences word order preferences. At the most simple level it is enough to state that the two classes of verbs do differ semantically, and also show a variety of syntactic correlates across many languages.

This is not the only factor determining word order in Spanish. When the pragmatic context changes informational focus, new information is preferentially placed in sentence-final position (e.g., Zagana, 2002; Zubizarreta, 1998). For example, in answer to a question like 'Who shouted in the street?' the appropriate word order would be VS. SV is then an anomalous option, even with an unergative verb like *gritar* (v-vi):

- | | | |
|------|--------------------------|----------------------|
| (v) | <i>Gritó el medico</i> | 'Shouted the doctor' |
| (vi) | <i>??El médico gritó</i> | 'The doctor shouted' |

Thus, both verb classes can be used in both word orders. The use of the 'dispreferred' word order in a particular context does not create ungrammaticality but a pragmatic anomaly (Hertel, 2003), which results in mild or intermediate unacceptability. The mapping of split intransitivity onto word order preferences is therefore argued to offer a 'poverty of the stimulus' problem for L2 speakers: on the surface the distribution of SV and VS order appears free because both verb-types are found with both word orders (e.g., Lozano, 2003)²⁵.

With respect to L2 speakers, there is evidence that they can acquire the broad knowledge that intransitive verb classes map onto syntactic correlates in the new language. However, L2 speakers may not show the same sensitivity as native speakers to these mappings. For example, Sorace (1993) found L2 speakers of Italian were sensitive to auxiliary selection being influenced by lexical properties, but did not show the same sensitivity to fine-grained distinctions related to the verb classes as native speakers.

In Chapter 2 I discussed several studies exploring the use of SV and VS word order with intransitive verbs in L1 and L2 speakers of Spanish (de Miguel, 1993; Hertel, 2003; Lozano, 2003, 2006). Overall, L1 Spanish speakers display the predicted lexical preferences. In contrast, L2 speakers of Spanish, for whom English is the L1, showed different and less stable lexical preferences for word order. Hertel and Lozano both found that L2 speakers at more advanced proficiencies do become sensitive to VS word order

²⁵ However, it could be argued that this is not a poverty of the stimulus situation because there are interface conditions determining when each word order should be used, and as such if the learner were sensitive to these interface contingencies could have enough information to acquire the constraints. Under this reasoning, where optionality is observed it is not due to the stimulus being impoverished, but the acquisition mechanisms not being sensitive to the conditions governing usage.

being more acceptable with unaccusatives than unergatives. However, their preferences remain notably different from those of native speakers, in particular because they overgeneralise VS to unergatives.

This pattern of L2 behaviour reflects L2 optionality. At all levels of proficiency, L2 speakers' treatment of the target language is characterized by indeterminacy, accepting two syntactic options as being appropriate in a particular context in a manner divergent from L1 speakers of that language. L2 speakers could, for example, acquire the general trend that VS is more acceptable with unaccusatives than unergatives, but still show non-native like behaviour in assessing word order appropriateness (e.g., overgeneralising VS to unergatives).

This thesis is primarily concerned with issues of language production, and Chapters 7-8 I address how these issues influence language production. However, in the current chapter I present an experiment designed to confirm how L1 and L2 word order preferences are influenced by intransitive verb class using a questionnaire.

6.4 Experiment 4: Word order preferences in L1 and L2 Spanish

Experiment 4 was designed to confirm that lexical factors do indeed affect the preference for linear word order in native speakers of Spanish, and additionally that L2 speakers do not show native-like preferences. Participants completed a questionnaire in which they rated a preference for SV versus VS word order for various sentence pairs. Half the sentence pairs used unergative verbs and half used unaccusative verbs. Participants were L1 Spanish speakers and intermediate-advanced L2 Spanish speakers (L1 English).

6.4.1 Participants

L1 participants were 18 native speakers of Castilian Spanish living in Madrid and Granada²⁶.

L2 participants were 20 native speakers of English living in Britain, with L2 Spanish. Participants were recruited by advertising for L2 speakers of Spanish with an

²⁶ Experiment 4 was designed as a pre-test for Experiments 5 and 6, to collect L1 preferences on the verbs to be used in the subsequent priming studies. Full data was not collected at the time about the language background of the L1 speakers. The L2 data was collected at a later stage, and so I collected additional background details, which are arguably more important for this group in any case.

‘intermediate to advanced level’ of Spanish. These participants filled out a language background questionnaire, including age, time spent in a Spanish-speaking country, age at which they started learning Spanish. In addition, participants rated their own proficiency in Spanish on a scale of 1 to 10, where 1 corresponded to ‘elementary’ and 10 corresponded to ‘advanced’. This was done for four measures: Speaking, Listening, Reading and Writing. See Table 6-1 for the L2 background details. Because I had advertised for intermediate-advanced proficiency speakers, I assumed the ratings to reflect at least an intermediate level of Spanish (the minimum self-rating was 4, maximum was 10).

Measure	Mean (standard deviation)
Age	24.6 (6.3)
Sex ratio	13F / 7M
Time spent in Spanish-speaking country (months)	6 (2.0)
Age of first exposure to Spanish ²⁷	14.6 (2.8)
Self assessments of Spanish level:	
Speaking	6.8 (2.1)
Listening	6.8 (1.9)
Reading	7.2 (2.0)
Writing	6 (2.0)

Table 6-1: L2 participant details for Experiment 4: This shows the means, with standard deviation in brackets.

6.4.2 Materials

Eight unaccusative and eight unergative verbs were chosen according to the following criteria: they would be easy to portray in a picture form (because I intended to use the same verbs in a subsequent production task involving picture description), intermediate L2 Spanish speakers would be familiar with them (as assessed by asking 2 intermediate learners of Spanish), and they could not be used in transitive constructions (e.g., not verbs

²⁷Although some participants had experience with Spanish at a younger age, they all had first consistent exposure to Spanish after the age of 13.

like *eat* which can be used in *the dog eats the bone*). The following unergative verbs were selected: *bailar* ('to dance'), *caminar* ('to walk'), *correr* ('to run'), *dormir* ('to sleep'), *gritar* ('to shout'), *llorar* ('to cry'), *nadar* ('to swim') and *reir* ('to laugh'). The following unaccusative verbs were selected: *caer* ('to fall'), *entrar* ('to enter'), *escapar* ('to escape'), *llegar* ('to arrive'), *salir* ('to leave'), *subir* ('to go up'), *venir* ('to come') and *volver* ('to return').

In addition, I chose 14 names of common professions in Spanish (e.g., *el médico* 'the doctor', *el professor* 'the teacher', *el artista* 'the artist') with which to pair the verbs.

I paired each verb with 2 different NPs, and then generated two sentences for each pairing, one using subject-verb (SV) order and the other verb-subject (VS), as in sentences (i) and (ii) respectively.

- (i) *El artista ha entrado* 'The artist has entered'
- (ii) *Ha entrado el artista* 'Has entered the artist'

Using these sentences, I then constructed the questionnaire. Each question consisted in a scale from 1 to 10, drawn from left to right with a line underneath it, as shown in figure 6-1. Above the scale at each end were the two versions of the same intransitive phrase, which differed only in word order. There were 32 questions in the questionnaire. Each verb appeared in two questions within the questionnaire; in one question the SV phrase was on the left side of the scale and the VS phrase on the right side of the scale, and in the other questions this order was reversed. The order of the questions within the list was randomised. Half the participants saw one version of this randomised list. The other half of the participants saw the same list but with the order of the questions reversed.

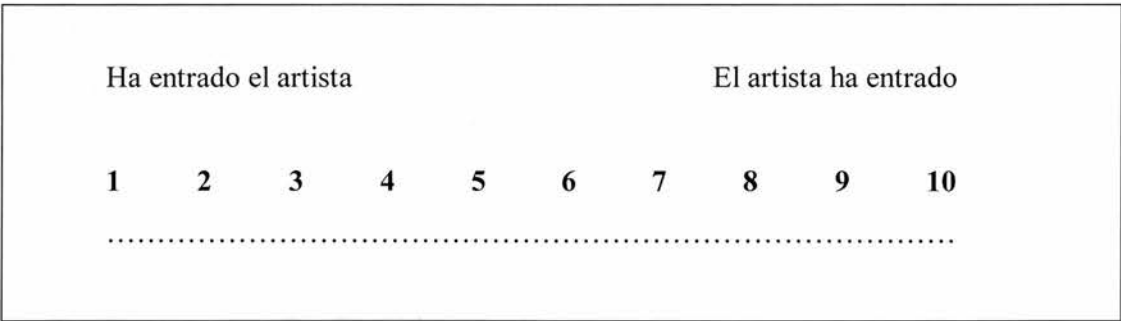


Figure 6-1: A sample scale from the questionnaire in Experiment 4, with two sentences above it. The sentence on the left uses VS order and the sentence on the right uses SV. In both cases, the sentence translates as *The artist has entered*.

6.4.3 Procedure

Questionnaires were e-mailed to participants as Word documents. Participants marked their answers on the questionnaire electronically and emailed them back to the researcher.

Instructions were given in the participant's native language at the top of the questionnaire. Participants were told to imagine they were watching a film on television with a friend and that the participant left the room for a while. On returning to the television room, the participant had no idea what had happened in the film and so asked their friend 'What happened?'. The friend knew that nothing interesting occurred and answered without enthusiasm. This scenario, and the question 'What happened?', was intended to make participants evaluate each pair of word orders as if in a 'null context', in which no discourse focus can influence word order (e.g., Hertel, 2003; Lozano, 2003, 2006).

Participants were told that the pairs of phrases were possible answers to the question "What happened?" and they must decide which of each pair seemed more natural in the context, indicating a low number if the left-hand sentence sounded better, a high number if the right-hand response sounded better, and a number in the middle if both were good, but still trying to indicate which was preferred.

6.4.4 Scoring

For each participant a score from '1' to '10' was recorded for each question, such that '1' always referred to preference for SV word order and '10' to preference for VS (note that this was purely for scoring purposes; recall that for participants, half of the sentences were presented with a preference for SV order anchored to 1 and half with a preference for SV order anchored to 10). For questions where '1' corresponded to a strong preference for SV order, the score recorded was the number indicated by the participant. For questions where '1' referred to a strong preference for VS order, the score recorded was obtained by subtracting the indicated number from 11 (for example, if a participant had marked an '8', indicating a preference for SV, the recorded score would be '3').

Because each verb was evaluated twice by each participant, in two different questions, mean scores were calculated from these two scores for each participant for

each verb. For each language group (L1 and L2), a score was then obtained for each verb by taking the mean across all participants in that group.

6.5 Results

I will discuss the L1 and L2 results separately.

6.5.1 L1 Spanish speakers

Table 6-2 shows the mean score across all participants for each verb, with the standard error in brackets.

Unaccusative verbs	Mean rating	Unergative verbs	Mean rating
caer	5.23 (.59)	bailar	4.45 (.44)
entrar	6.08 (.53)	caminar	3.83 (.38)
escapar	4.63 (.50)	correr	3.19 (.32)
llegar	6.35 (.55)	dormir	5.08 (.58)
salir	4.40 (.46)	gritar	4.03 (.58)
subir	4.78 (.54)	llorar	4.19 (.44)
venir	6.94 (.38)	nadar	3.86 (.36)
volver	5.13 (.52)	reir	3.69 (.37)
All unaccusatives	6.04 (.38)	All unergatives	4.30 (.23)

Table 6-2: The mean rating across all L1 participants for each verb type (standard error of mean in brackets).

As can be seen from the table, overall the L1 participants gave higher scores (and thus a higher preference for VS over SV order) to the sentences involving unaccusative verbs than those involving unergative verbs. To check the reliability of these ratings, I performed a *t*-test comparing the mean scores across the two verb-groups (paired within participants, independent across items).

Results showed the unaccusative scores to be significantly higher than the unergative scores ($t_1(17) = 6.7, p<.001$; $t_2(14) = 3.7, p<.005$) indicating that L1 participants preferred VS with unaccusatives than with unergatives. I then examined whether the ratings for each verb group were significantly different from 5.5, that is, from

an equal preference for both word orders. Another *t*-test showed the unergative scores to differ significantly from 5.5, indicating a preference for SV over VS ($t_{1(17)} = 4.8$, $p < .001$; $t_{2(7)} = 7.2$, $p < .01$). However, there was no significant difference for the unaccusative scores, indicating an equal preference for SV and VS ($t_s < 1.6$).

In addition, I looked at the mean ratings given by individuals for the two types of verbs. As can be seen from the means in Table 6-3, 17 of the 18 participants rated VS as more appropriate with unaccusatives than unergatives (only participant 17 did not), indicating that the large majority of the L1 speakers showed the predicted direction of preference for VS with unaccusatives vs. unergatives.

Participant	Mean unacc rating	Mean unerg rating
1	5.43 (.34)	3.94 (.29)
2	6.14 (.30)	5.31 (.35)
3	7.25 (.48)	6.19 (.62)
4	3.36 (.52)	3.25 (.34)
5	4.94 (.19)	4.16 (.18)
6	4.44 (.90)	3.31 (.55)
7	6.25 (.60)	5.00 (.67)
8	5.38 (.88)	3.31 (.16)
9	5.50 (.61)	3.75 (.43)
10	4.81 (1.22)	3.00 (.62)
11	4.88 (.99)	4.38 (.65)
12	4.94 (1.01)	1.56 (.56)
13	4.19 (.67)	1.81 (.13)
14	7.06 (.55)	4.50 (.60)
15	6.56 (.72)	4.81 (.80)
16	6.94 (1.12)	5.56 (1.00)
17	5.44 (.76)	5.81 (.53)
18	5.06 (.78)	3.31 (.43)

Table 6-3: The mean ratings from each L1 participant for each verb type (standard error of mean in brackets).

6.5.2 L2 Spanish speakers

Table 6-4 shows the mean score across all participants for each verb, with the standard error in brackets.

Unaccusative verbs	Mean rating	Unergative verbs	Mean rating
caer	4.33 (.45)	bailar	5.20 (.43)
entrar	4.67 (.39)	caminar	4.93 (.49)
escapar	4.35 (.36)	correr	4.85 (.46)
llegar	5.25 (.40)	dormir	5.43 (.33)
salir	5.23 (.40)	gritar	4.87 (.47)
subir	4.47 (.35)	llorar	4.15 (.47)
venir	4.85 (.54)	nadar	4.43 (.39)
volver	5.35 (.43)	reir	4.88 (.34)
All unaccusatives	4.81 (.26)	All unergatives	4.84 (.27)

Table 6-4: The mean rating across all L2 participants for each verb type (standard error of mean in brackets).

As can be seen from Table 6-4, overall the L2 participants did not appear to differ in their word order preferences with respect to the two lexical classes. Indeed, the mean group ratings were remarkably similar for the unaccusative and unergative verbs (4.81 vs. 4.84). A *t*-test comparing the mean scores across the two verb-groups (paired within participants, independent across items) confirmed this lack of effect: there was no significant difference in the word order ratings for the unaccusative compared with the unergative verbs ($t_{s<.16}$), indicating no differential preference for VS associated with the two verb classes.

I also analysed whether the mean scores for each verb class differed significantly from 5.5. For both the unergative and unaccusative verbs there was a significant preference for SV word order, as indicated by the scores being significantly lower than 5.5 (unergatives: $t_1(19) = 2.4, p<.05$; $t_2(7) = 4.6, p<.01$; unaccusatives: $(t_1(19) = .2.6, p<.05$; $t_2(7) = .4.6, p=.01)$).

In addition, as with the L1 speakers, I looked at the individual participant mean ratings for the two types of verbs, to give an overall view of preferences across different

learners. These means can be found in Table 6-5, along with the self-rated proficiency of each L2 speaker. In contrast to the L1 data, there was no consistent pattern of word order preferences associated with the two verb types: 8 participants rated VS as more appropriate with unaccusatives than unergatives, 7 rated VS as more appropriate with unergatives than unaccusatives, and 5 gave similar ratings for the two verb groups (did not differ by more than 0.1).

Participant	Mean proficiency (/10)	Mean unacc rating	Mean unerg rating
1	4	5.38 (.30)	5.38 (.43)
2	5	2.00 (.00)	2.00 (.00)
3	6.25	5.38 (.72)	3.94 (.41)
4	6.5	4.88 (.73)	6.88 (.49)
5	7	5.94 (.21)	5.87 (.33)
6	7	6.38 (.41)	5.38 (.67)
7	7	5.88 (.32)	5.75 (.43)
8	7.25	3.69 (.48)	4.00 (.78)
9	7.75	4.00 (.53)	4.81 (.81)
10	7.75	6.56 (.23)	6.44 (.35)
11	7.75	5.19 (.22)	5.44 (.37)
12	7.75	5.19 (.67)	5.13 (.61)
13	8	4.44 (.77)	5.81 (.69)
14	8	3.31 (.29)	2.94 (.18)
15	8	5.38 (.57)	4.63 (.32)
16	8.5	4.50 (.63)	4.44 (.56)
17	8.5	4.06 (.28)	4.50 (.33)
18	9	6.38 (.41)	4.88 (.48)
19	10	4.25 (.46)	5.63 (.31)
20	10	3.50 (.57)	3.00 (.59)

Table 6-5: The mean ratings from each L2 participant for each verb type (standard error of mean in brackets) along with their mean proficiency ratings

Finally, I assessed whether these preferences were correlated to proficiency. I calculated a measure of how different the L2 speaker’s word order preferences were across the two

verb types by subtracting the mean rating for unergative verbs from the mean rating for unaccusative verbs. I then compared this to the L2 speaker’s mean self-assessment of proficiency in Spanish. Figure 6-2 shows the mean proficiency rating for each participant (out of ten) against the unaccusative-unergative rating difference. As the graph makes clear, there was no relationship between the proficiency rating and the difference in word order ratings, and this was supported by no significant correlation between the two ($N = 20$, Spearman’s rho correlation coefficient = .038).

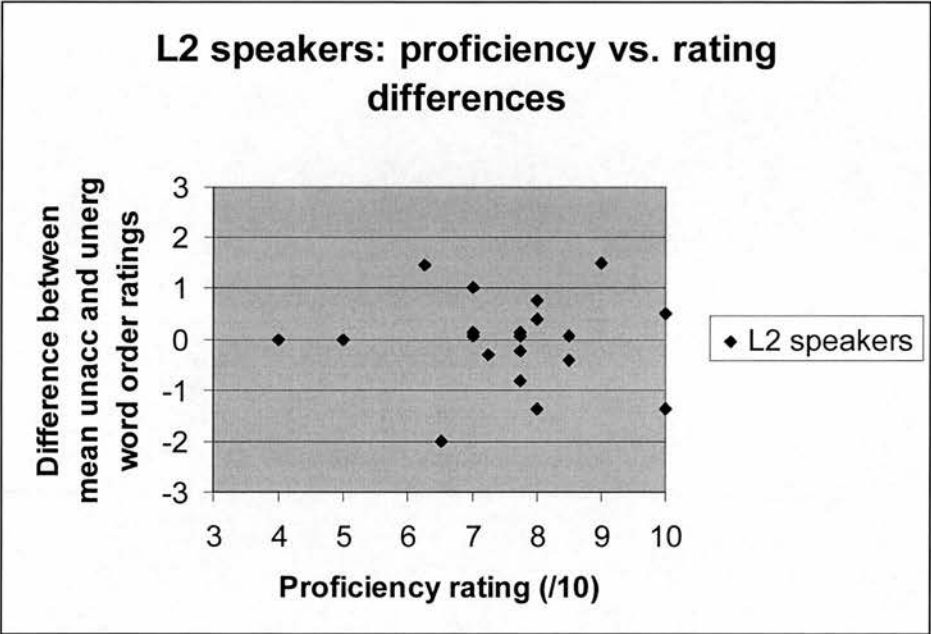


Figure 6-2: A graph plotting the L2 participants’ self assessment of proficiency (/10) against the differences between their mean ratings of VS with the unaccusative and the unergative verbs groups. A positive value on the y-axis demonstrates that the participant preferred VS structure to SV when it was used with unaccusative verbs than when it was used with unergative verbs. A negative value on the y-axis demonstrates that the participant preferred VS structure to SV when it was used with unergative verbs than when it was used with unaccusative verbs. A rating difference of 0 shows no numerical difference in the acceptance of VS word order across unaccusative and unergative verbs.

It therefore appears that intermediate to advanced L2 speakers show variable behaviour in terms of their word order preferences associated with particular verbs. Only some L2 speakers demonstrated sensitivity to VS word order being more acceptable with

unaccusatives in Spanish; furthermore, any such sensitivity was not linked to self-rated proficiency.

6.6 Discussion

Experiment 4 was designed to assess how the choice of intransitive verb in a construction affects L1 and L2 speakers' preference for SV vs. VS word order. Results showed that native speakers of Spanish rated VS order as significantly more natural with unaccusative than unergative verbs. In contrast, the intermediate-advanced L2 speakers of Spanish (L1 English) showed more variable preferences and overall did not appear to treat the two verb groups as different. L2 participants rated VS word order as equally acceptable with unergative and unaccusative verbs, and did not show significant changes in preferences with proficiency. The difference in the effects found in L1 and L2 speakers suggests a difference in the way that intransitive verbs and word order are represented and processed, as compared to L1 speakers.

The results show that in L1 speakers, linear word order preference is affected by the properties of the lexical items involved, at least in an off-line rating study, as shown in various previous studies (de Miguel, 1993; Hertel, 2003; Hertel & Pérez-Leroux, 1999; Lozano, 2003, 2006). These studies also found L2 speakers to show different and less stable lexical preferences for word order compared to L1 speakers (e.g., de Miguel, 1993; Hertel, 2003). There was no clear pattern of word order preferences correlated with verb-type across the L2 group, and participants showed disparate preferences. In addition, I found no relationship between L2 proficiency and the difference in unaccusative and unergative ratings given by L2 participants. This contrasts with previous studies, which did find a developmental effect. For example, Hertel (2003) found that at lower proficiencies L2 speakers of Spanish (L1 English) produced very few VS structures, but as VS structures appeared with increased proficiency, so did a tendency to use VS more with unaccusative than unergative verbs. At advanced proficiency levels, L2 participants overgeneralised VS order to unergative verbs. In contrast, the results of Experiment 4 showed no effect of proficiency. This may reflect that Hertel's study used larger groups of participants with the aim of finding developmental trends; alternatively, it might be that the self-rating used in the current study was not an accurate enough measure of

proficiency for effects to emerge. Nevertheless, the main observation of interest was that these intermediate-advanced L2 speakers as a group had not acquired native-like preferences for word order in Spanish. Hence, the most important finding of Experiment 4 is that the L1 and L2 speakers displayed different patterns of word order preferences, with L1 but not L2 speakers displaying preferences that were consistently conditioned by whether the verbs were unergative or unaccusative.

It should be noted, however, that even the L1 speakers did not demonstrate strong categorical preferences (i.e., SV order with unergatives and VS order with unaccusatives). Rather, mean scores tended to fall in the middle of the scale, indicating that both word orders were acceptable with all the verbs. The differences observed across lexical classes were therefore trends rather than absolute preferences. This reflects the fact that lexical effects on word order represent a soft grammatical constraint, which when violated causes only intermediate ungrammaticality (e.g., Sorace & Keller, 2005). A hard constraint would cause categorical preferences. In addition, factors such as focus can influence word order preferences in Spanish and although the instructions intended for participants to rate each sentence-pair with respect to a neutral context, the personal interpretation participants apply to each sentence is difficult to control. Participants could have assessed word orders by imposing their own discourse focus, such that they could imagine a context in which the verb in questions would be appropriate with either word order.

A final observation is that, within each verb class, the treatment of the verbs was not homogeneous. Although the L1 speakers overall show significantly different preferences for unaccusative and unergative verbs, there is overlap of preferences for the verbs within the two groups: ratings sitting along a continuum. This could be explained simply as noise within the data, due to variance in individual's ratings, or an artefact of collecting data on a scale in this way (e.g., participants may tend to choose scores in the middle of the scale).

Given that my primary interest is in production and not comprehension, it is enough to conclude that L1 speakers do show a clear preference for VS word order with unaccusative verbs compared to with unergative verbs. In contrast, L2 speakers

demonstrate a less stable grasp of the way in which lexical factors influence word order preferences in Spanish.

In the next chapter I explore how these L1 and L2 lexical preferences influence the stage of production which is concerned with processing word order.

6.7 Summary

The previous chapters of this thesis explored whether the same representations and processes are involved in L1 and L2 sentence production, with a focus on structures that differed in terms of hierarchical structure. In the current chapter I discussed whether L1 and L2 similarities would also be found in word order processing. Specifically, I addressed whether word order selection is influenced by lexical factors in L1 and L2 speakers of Spanish. I then presented a preliminary experiment which used an acceptability-rating task to confirm previous findings that L1 speakers prefer subject-verb word order with unergative verbs and verb-subject word order with unaccusative verbs, but that L2 speakers are less sensitive to this distinction. In Chapter 7 I investigate this issue further using syntactic priming in production.

7 Syntactic priming of word order using intransitive verbs

7.1 Overview

In the previous chapter I discussed how word order preferences in L1 Spanish are influenced by properties of two classes of intransitive verbs, but L2 speakers of Spanish have difficulties in learning how these lexical factors map onto word order choice. The results of an off-line rating task supported previous findings that L1 speakers of Spanish prefer preverbal subjects with unergative verbs and postverbal subjects with unaccusatives. However, L2 speakers of Spanish showed no consistent word order preferences that related to the verb involved.

In the current chapter I explore whether these preferences influence production and syntactic priming. Pre- vs. post-verbal subjects (SV vs. VS respectively) were primed in L1 and L2 speakers of Spanish, using either unergative or unaccusative verbs. I also varied whether the prime and target used the same verb, to investigate how lexical preferences might affect a lexical boost. A lexical boost has not previously been demonstrated for word order priming, but would suggest that abstract representations of possible word orders are linked to specific lemma items, as has been proposed for other combinatorial information (e.g., Pickering & Branigan, 1998). I will discuss implications of the results for a comparison of L1 and L2 production, and also more generally for models of language production.

Finally, I explore whether the L1 ratings for individual verbs in Experiment 4 correlated with the magnitude of priming and lexical boost found in L1 speakers in Experiment 5.

7.2 Introduction

The results of the rating task in Experiment 4 showed that native speakers of Spanish preferred different word orders depending on the class of verb involved: in a neutral context, VS order was considered more appropriate with unaccusative than unergative verbs. In contrast, English-L1 speakers who speak L2 Spanish showed more variable preferences with no consistent preferences across participants.

As we have seen, the distinction between unergative and unaccusative verbs may be treated as semantic, syntactic, or both, depending on the linguistic theory that is adopted. For the purposes of the current study it is not important whether a semantic, syntactic or semantic-syntactic account is adopted; the important factor is that some characteristic specific to particular lexical items influences word order preferences²⁸.

Experiment 4 used an off-line comprehension study. However, the main aim of this thesis is to investigate sentence *production* in L1 and L2 speakers. In the current chapter I therefore investigate the issue of intransitive verbs and word order preferences further, but in production. I present a study using syntactic priming to isolate word order processing in production: Experiment 5 primed SV vs. VS word order in L1 and L2 speakers of Spanish, using either unergative or unaccusative verbs. I also varied whether the same verb was repeated across the prime and target or not, in order to look for a lexical boost to priming (although when the verb was different verb, it was still from the same verb-class). This experiment was designed to compare L1-L2 processing at the level where linear order is specified. I examined whether the lexical preferences explored in Experiment 4 are mirrored by similar preferences in real-time production, and how this might differ across L1 and L2 speakers.

I begin by discussing what is assumed about word order processing in L1 production models, and how this might transfer to L2 production. I then address how lexical characteristics might influence processing of linear word order in L1 and L2 speakers, making specific predictions for the current study.

7.2.1 Word order processing in L1 production models

It is generally accepted that at some stage in production word order has to be computed, although the details of when and how it is specified vary across different models. For example, we have seen that Bock & Levelt (1994) implicate two processing levels in specifying a final constituent structure. Firstly, during functional processing grammatical roles are assigned and semantic-syntactic information about lexical items is available as

²⁸ Indeed, in Levelt's (1989) model of language production he defined a lemma as a bundle of semantic and syntactic features associated with a lexical item. In this sense, if we are interested in the lemma level (as representing the stage in language production where syntax becomes available), the semantic-syntactic distinction becomes less important.

lemmas are selected. Secondly, during positional processing an ordered frame is assigned to constituents, determining the final linear word order. Other approaches suggest that hierarchical structure and linear order are computed separately (e.g., Hartsuiker & Westenberg, 2000; Kempen & Hoenkamp, 1987; Vigliocco & Nicol, 1998). For the purposes of the current study, the question of when word order is specified is less interesting than that of whether it is influenced by lexical preferences and whether this varies across L1 and L2 speakers.

To date there has been little examination of how real-time production of word order might occur in L2 speakers. Syntactic priming offers a method for isolating particular aspects of sentence-level production in an experimental context, and so offers an opportunity to compare this processing in L1 and L2 speakers. As seen in Chapter 2, word order priming has been demonstrated in previous studies (Hartsuiker, Kolk & Huiskamp, 1999; Hartsuiker & Westenberg, 2000). Most convincingly, Hartsuiker and Westenberg primed the order of auxiliary verb and past participle in Dutch subordinate clauses, despite both word orders being associated with the same phrasal and conceptual structures. They attributed the priming effect to persistence at a level of linearisation, which imposes linear order of constituents on a representation not yet specified for linear relations. If priming can be found in L2 speakers this would suggest that L2 speakers also possess abstract knowledge about word order options, even for options that do not exist in their L1 (because a bare VS structure is not a viable option in the English).

7.2.2 Evidence for lexical influences on syntactic processing in production

Experiment 4 showed that lexical factors can influence rating of word order in an off-line task and that this differs in native and non-native speakers. One objective of the current study was therefore to look at how these preferences might be manifested in production, and how this differs across L1 and L2 speakers.

There is little existing evidence supporting that the characteristics (semantic or syntactic) of individual lexical items can influence word order production independent of functional processing (e.g., grammatical role assignment). Chapter 2 reviewed experimental evidence for lexical factors influencing some aspects of syntactic structure choice in L1 language production. The conceptual properties of NPs have been seen to

affect function assignment: more animate, concrete and prototypical nouns tend to appear in more prominent syntactic positions (e.g., Bock, 1986; Bock & Loebell, 1990; Bock & Warren, 1985; Christianson & Ferreira, 2005; Kelly, Bock, & Keil, 1986; McDonald, Bock, & Kelly, 1993; Sridhar, 1988). There is also evidence that the conceptual properties of verbs can influence function assignment in L1 speakers (F.Ferreira, 1994). However, there is only limited evidence that conceptual factors can influence linear word order, independent of grammatical roles (e.g., McDonald, Bock, & Kelly, 1993; Prat-Sala & Branigan, 2000; Tanaka et al., 2005) and no experimental evidence comparing this in L1 and L2 speakers.

There must be some mechanism whereby lexical factors influence word order processing in L1 speakers, in order to account for the behaviour of intransitive word order preferences in Spanish seen in Experiment 4. So, what would constitute evidence for these factors influencing L1 and L2 word order production in the current priming study?

A primary finding that we might expect would be that, overall, L1 speakers produce more VS structure with unaccusative verbs than with unergative verbs. This would mirror the results of Experiment 4 and suggest that the likelihood to use a particular word order is influenced by the lexical class to which the verb belongs. The L2 speakers in Experiment 4 showed no clear preferences for word order associated with lexical classes, and therefore might be expected to show no difference in proportions of VS across different verbs. However, Experiment 4 was a comprehension rating task, and there is evidence that advanced L2 speakers may acquire and apply in production the broad distinction that VS are more acceptable with unaccusatives, but overuse VS order with unergatives (Hertel, 2003). Therefore, the L2 speakers may produce more VS order with unaccusatives in general, but still produce more VS than native speakers with unergatives.

Secondly, lexical preferences for word order might influence the magnitude of syntactic priming in language production; if a speaker finds a verb class more acceptable with a particular word order, they may be more susceptible to priming of that word order with a verb from that class. Experiment 4 showed L1 Spanish speakers prefer SV word order with unergatives, and VS with unaccusatives. In addition, previous studies have

shown native Spanish speakers to strongly disprefer SV order with unergatives (e.g., Hertel, 2003, found L1 speakers produced only 7% VS order with unergatives in a neutral context). How would this affect priming? The combined results of Experiments 1-3 support that if a particular structure is dispreferred or infelicitous then priming of that structure is difficult in native speakers (see also Hartsuiker & Kolk, 1998a; Pickering, Branigan & McClean, 2002). By extending this argument to lexical preferences, L1 speakers find VS word order infelicitous with unergative verbs in a neutral context²⁹, so they may resist priming if the verb is unergative. In contrast VS order is preferred with unaccusative verbs, so VS priming should be easier for sentences involving unaccusative verbs. With respect to the non-native speakers, however, Experiment 4 showed L2 speakers of Spanish to have no clear preference for either word order in an off-line rating task, and no preference for VS with unaccusatives compared to unergatives. There were some speakers who showed the appropriate preferences, but overall there was no trend in the L2 behaviour, suggesting that any L2 preferences are unstable and unpredictable. Therefore, L2 susceptibility to priming would be predicted to be similar across the two verb classes.

To date, there has been little exploration of how lexical preferences for structures interact with priming effects (although see Ferreira, 2003a,b). Instead, priming studies have selected verbs that can be acceptably used with the two primed alternatives, and looked for a priming effect across different verb items. If unaccusative and unergative verbs behave differently in an L1 priming context this would be further evidence for lexical factors affecting word order production. In addition, this would have implications for accounts of syntactic priming, which would have to account for individual verbs behaving differently in the same priming context. This would not be a surprising result, but has not previously been explored.

A third demonstration of lexical involvement in word order production would be a lexical boost to word order priming – the finding that repeating the verb across prime and target enhances the persistence of the primed structure. The lexical boost is well

²⁹ By 'neutral' context, I mean an 'out of the blue' context with no discourse effects on whether particular constituents are on-going topics or are in focus. As mentioned before, focused constituents tend to appear in sentence-final in Spanish, irrespective of the verb involved. The current study therefore intended for each target to be treated as an out-of-the-blue description and thus elicit neutral word order preferences.

established for structures that vary in terms of functional or hierarchical features (Branigan et al., 2000; Cleland & Pickering, 2003; Pickering & Branigan, 1998; Experiments 1 and 2, this thesis). The existence of the lexical boost demonstrates an influence of lexical factors on the aspect of syntactic formation which it affects. For example, the boost found in Experiments 1 and 2 can be attributed to a link between lexical representations and representations of the passive, which is itself strengthened when the two co-occur, leading to further priming (Pickering & Branigan, 1998). There has been no previous demonstration of a lexical boost to word order priming in L1 speakers, but if lexical overlap can enhance priming of linear word order this would indicate that lexical factors also influence word order processing. If a lexical boost is also found in L2 speakers, the same implications for the linguistic architecture can be applied to both native and non-native speakers (e.g., specific primable links existing between abstract word order representations and lemmas).

Fourthly, the size of the lexical boost might vary depending on the verb involved. For example, in L1 speakers, if the association between VS structure differs for the two verb classes, the size of the lexical boost may also vary depending on the verb class involved. Unergative verbs may resist the lexical boost, because in a neutral context VS word order is considered inappropriate or infelicitous. In contrast, the link between unaccusative and VS word order should be strong, enabling a stronger lexical boost. In contrast, Experiment 4 suggested that L2 speakers show less sensitivity to the constraints on using VS with unergative verbs in Spanish, so any difference in the lexical boost across verb-type would be predicted to be smaller for the L2 group than the L1 group.

A final note is that the finding of lexical effects on word order production will have implications for current models of language production. In the discussion, I will deal with possible explanations for any word order effects in terms of current accounts of syntactic processing.

7.2.3 Summary

In sum, results from Experiment 4 produced preliminary evidence for lexical factors influencing linear word order preferences, due to differences in the word order preferences of unergative and unaccusative verbs. I now present a syntactic priming

experiment looking at word order in production using structures that have not previously been used in a priming study: SV vs. VS word order. If word order priming can be found in L2 speakers as well as L1 speakers, this would imply similar representations and processes are involved in processing word order in native and non-native speakers. I also looked for a lexical boost on priming of word order in L1 and L2 speakers. This has not previously been demonstrated, and would suggest the existence of associations between specific lexical items and representations of word order (as has been suggested for phrasal structure representations). Finally, I look for differences in the way intransitive verbs are processed, predicting that L1 speakers would produce more VS order, stronger priming, and a stronger lexical boost to priming with unaccusative than unergative verbs. In contrast, L2 speakers were not expected to show strong distinctions in the way the two verb types were processed, reflecting an insensitivity to the strength of lexical associations with word order.

Finally, I note that few previous priming studies have used intransitive verbs in production, and indeed intransitive constructions are often used as a baseline in syntactic priming studies (e.g., Hartsuiker, Pickering & Velkamp, 2004; Pickering, Branigan & McClean, 2002). Finding increased word order priming using these constructions would therefore also constitute a novel priming effect, and arguably demonstrate priming at the simplest level.

7.3 Experiment 5: Word order priming in L1 and L2 Spanish

7.3.1 Participants

80 participants were paid £5 to take part in the experiment (assessed as in Experiments 1 and 2). 40 participants were native speakers of Spanish. The other 40 participants were English-L1 speakers with intermediate to advanced L2 Spanish (see Table 7-1 for details). Their proficiency in Spanish was evaluated using the same Cloze test as in Experiments 1 and 2. Half the participants would see unergative primes and targets, and

half would see the unaccusative materials. The L2 participants who saw unergatives and unaccusatives were carefully matched in terms of proficiency³⁰.

Participant Group	Age	Age started learning Spanish	Female / Male	Time in L2-country (months)	Cloze score (out of 50)
<u>Unergatives</u>					
L1 Spanish	27 (3.8)	N/A	10F / 10M	7.1 (3.4)	N/A
L2 Spanish	21 (3.0)	14.6 (3.4)	13F / 7M	7.4 (12.9)	33.7 (7.3)
<u>Unaccusatives</u>					
L1 Spanish	25.9 (6.3)	N/A	10F / 10M	6.5 (5.4)	N/A
L2 Spanish	24.4 (6.3)	14.8 (4.0)	15F / 5M	6.9 (7.4)	34.5 (7.4)

Table 7-1: Details for participants in Experiment 5, showing the mean age, time spent in an L2-speaking country (for the L1 Spanish group this meant ‘English-speaking country’, for the L2 Spanish groups this meant ‘Spanish-speaking country’), and score on the Cloze test. Standard deviations are shown in brackets.

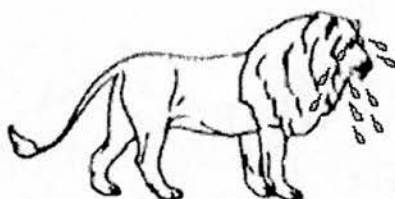
7.3.2 Materials

I constructed two sets of 64 pictures depicting intransitive actions being performed by an animal. I chose animals because they were easy to depict and recognize, and many names could be generated with which Intermediate L2 speakers were likely to be familiar. The relevant verb was printed in the infinitive form beneath the picture. One set of pictures were for matching to prime descriptions (Matching pictures) and the other set were for target descriptions (Description pictures).

12 animals appeared across the 64 Description pictures and a different 11 animals appeared across the 64 Matching pictures. On each of the pictures was printed one of sixteen Spanish verbs, each verb appearing on four Description pictures and four Matching pictures. The verbs were the same as those used in Experiment 4 (i.e., 8 unergative and 8 unaccusative).

³⁰ 48 L2 participants were recruited and completed the Cloze test, but 8 were then excluded from the experimental task because either their proficiency was too low (scored less than 20 on the Cloze test), or because this would better match the proficiencies across the unergative and unaccusative participant groups.

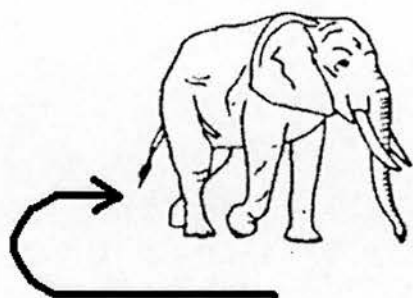
For each Matching picture two prime sentences were generated, one used subject-verb (SV) word order and the other used verb-subject (VS) word order. The Description and Matching pictures were paired as in Experiment 1, creating two sets of four lists (one with the unergatives, one with the unaccusatives) and appropriate prime sentences were generated. Separate lists were prepared for the unergative and unaccusative items as in Experiment 1, in both same-verb and different-verb conditions. Figures 7-1 and 7-2 show examples of unergative and unaccusative Description pictures, along with the prime sentences with which they were paired (i-iv and v-viii respectively).



LLORAR

Figure 7-1: An example of an unergative Description picture

- (i) *El zorro llora* 'The fox cries' (same verb, SV construction)
- (ii) *Llora el zorro* 'Cries the fox' (same verb, VS construction)
- (iii) *La araña duerme* 'The spider sleeps' (different verb, SV construction)
- (iv) *Duerme la arena* 'Sleeps the spider' (different verb, VS construction)



VOLVER

Figure 7-2: An example of an unaccusative Description picture

- (v) *La oveja vuelve* 'The sheep returns' (same verb, SV construction)
- (vi) *Vuelve la oveja* 'Returns the sheep' (same verb, VS construction)
- (vii) *El conejo viene* 'The rabbit comes' (different verb, SV construction)
- (viii) *Viene el conejo* 'Comes the rabbit' (different verb, VS construction)

I also constructed 104 filler Description pictures and 104 filler Matching pictures, the latter being paired to 104 sentences describing the pictures. 72 of the Description fillers and 72 of the Matching fillers depicted a single inanimate object with an adjective written in the masculine form beneath the object. Participants were required to describe this object using the adjective provided. For the sentences corresponding to half these Matching filler pictures, the object in the sentence was different to that depicted. The other filler pictures depicted two inanimate objects with the conjunction *y* ('and') written between them. Participants described this picture by making a conjunction description like *la guitarra y el televisor* ('the guitar and the television'). For the sentences corresponding to half the Matching filler pictures, only one of the nouns in the sentence matched the objects depicted, to generate 'no' responses in the matching task. The filler items were the same for the unergative and unaccusative lists.

Individually randomized lists were prepared separately for the unergative and unaccusative verbs, each containing the 32 experimental items and the 208 filler items

with the stipulation that at least two fillers intervened between any two experimental items.

7.3.3 Procedure

As in Experiment 2 (see section 4.4.3).

7.3.4 Scoring

Each description of a target picture was scored as being SV, VS or Other. An intransitive picture description was scored as an SV if it contained a single subject NP, followed by an intransitive verb. An intransitive picture description was scored as VS if it contained an intransitive verb followed by a single subject NP. All other descriptions were counted as Others, and included NPs with relative clauses (e.g., *la serpiente que ríe*, ‘the snake which laughs’; *un gato que duerme*, ‘the cat which sleeps’) or an SV structure which was not reversible to VS (e.g., *el pez nadando*, ‘the fish swimming’ – **nadando el pez*, ‘swimming the fish’, is not permissible in Spanish). If the participant failed to respond, or used a verb other than that specified in their description, this was discounted, and not included in any of the scores.

7.4 Results

Scoring according to the criteria described above yielded a total of 2519 responses (1271 in the unaccusative condition, 1248 in the unergative condition). Of these there were 1877 SV responses (74.5%), 577 VS responses (22.9%) and 65 Other responses (2.6%).

In the unaccusative condition, there were 846 SV responses (66.6%), 425 VS responses (33.4%), and no Other response. In the unergative condition, there were 1031 SV responses (82.6%), 152 VS responses (12.2%), and 65 Other responses (5.2%).

All the Other responses therefore occurred in the unergative condition (48 were produced by the L1 group, and 17 by the L2 group). Of these responses 20% occurred in the same-verb VS condition, 12% in the same-verb SV condition, 32% in the different-verb VS condition, and 35% in the different-verb SV condition. A pairwise comparison (paired in the participants analysis, independent in the items analysis) showed that significantly less Other responses were produced when the verb was the same in prime

and target as when it was different ($t_1(1,79)=2.549, p<.05$; $t_2(1,63)=2.640 p<.05$). This suggests that priming of an intransitive form as opposed to another form was more likely when there was lexical overlap in prime and target. The lexical boost therefore appeared to facilitate persistence at other levels too – not just the choice between the two different word orders, but the choice of an intransitive construction as opposed to any other structure.

I computed a measure designed to determine the relative proportions of SV and VS target responses in each of the priming conditions. This measure was the number of VS target responses divided by the sum of all SV and VS responses in that condition; I excluded the ‘Other’ responses from the denominator in this calculation, because of the finding above that the number of Others was skewed across the verb conditions. The computed measure was therefore intended to show the likelihood of producing a VS structure, given that the participant produced either SV or VS.

The distribution of SV structures was complementary to that of VS structures. However, previous findings show the biggest difference in word order preferences between L1 and L2 Spanish speakers emerges in the treatment of VS, not SV (e.g., Lozano, 2003, 2006). I therefore focus on production of VS structures in the analysis.

The numbers of VS responses in each prime condition, based on participant means across native and non-native speakers, are listed in Table 7-2. The results can also be seen in graphical format in Figure 7-3.

		SV /Same Verb	SV / Diff Verb	VS / Same Verb	VS / Diff Verb
L1	Unerg	.03	.00	.14	.10
	Unacc	.08	.09	.46	.28
L2	Unerg	.04	.04	.39	.22
	Unacc	.23	.28	.68	.58

Table 7-2: The proportion of VS order produced by L1 and L2 speakers in Experiment 5 in each prime condition.

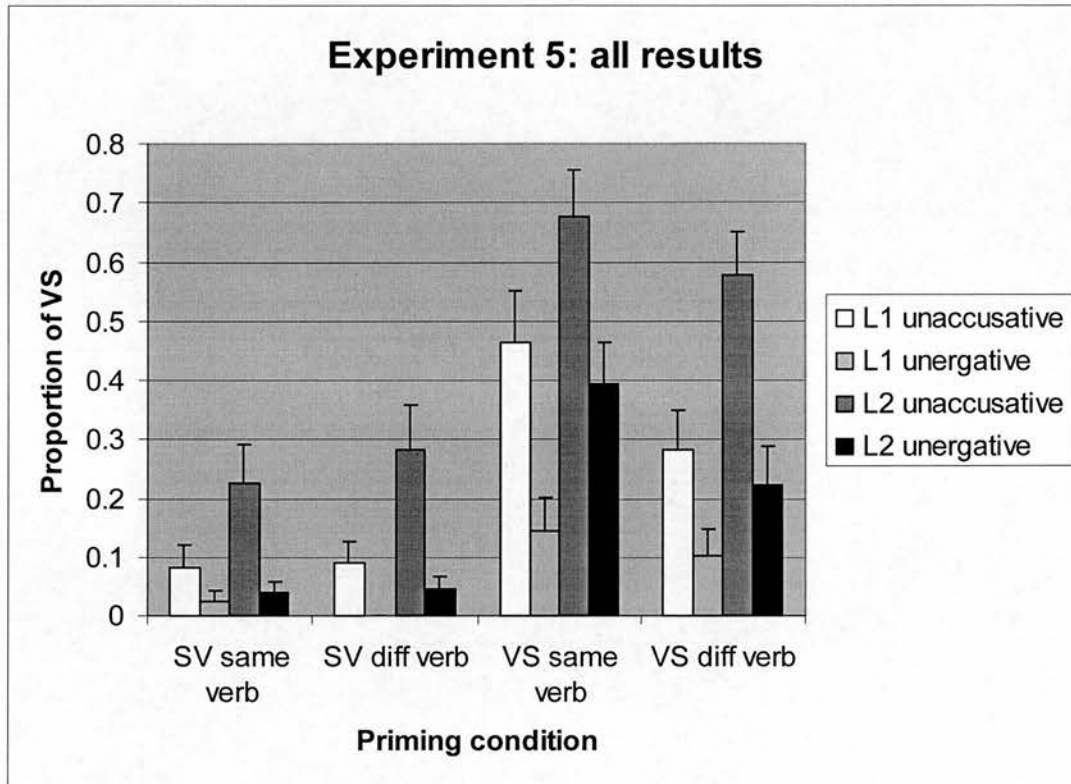


Figure 7-3: The proportion of VS produced overall in Experiment 5 across all conditions, shown separately for the L1 and L2 speakers and the unergative and unaccusative conditions. The prime conditions were SV same verb, SV different verb, VS same verb, and VS different verb. Bars represent standard error values.

The pattern of results shown in Table 7-2 shows that there is syntactic persistence for the primed VS word order in both L1 and L2 Spanish: participants were more likely to produce VS order having read a VS prime than an SV prime. In order to explore the data further, I performed a mixed design four-factor ANOVA, with the factors Native Language (L1 vs. L2), Verb Class (unergative vs. unaccusative), Prime (SV vs. VS), and Verb Identity (Same vs. Different). (Verb Class was a between-participants and between-items factor; Prime and Verb Identity were within-participants and within-items; Native Language was a between-participants factor and a within-items factor). I conducted two ANOVAs, one with participants as a random factor ($F1$) and one with items as a random factor ($F2$). In this design, an effect of word order priming should be reflected as a significant effect of Prime, and a lexical boost should be reflected as a significant interaction of Prime and Verb Identity. The results can be seen in Table 7-3.

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Prime	1,76	89.271***	.060	1,62	226.488***	.038
Prime x Verb Identity	1,76	26.259***	.014	1,62	13.567***	.043
Verb Identity	1,76	21.318***	.012	1,62	13.736***	.027
Verb Class	1,76	21.483***	.171	1,62	282.355***	.020
Prime x Verb Class	1,76	6.732*	.060	1,62	17.327***	.038
Prime x Verb Identity x Verb Class	1,76	2.144	.014	1,62	1.129	.043
Native Language	1,76	11.893**	.171	1,62	159.571***	.020
Prime x Native Language	1,76	4.831*	.060	1,62	23.791***	.018
Native Language x Verb Class	1,76	1.270	.171	1,62	17.800***	.020
Prime x Verb Identity x Native Language x Verb Class	1,76	3.332 (<i>p</i> =.072)	.014	1,62	4.414*	.018
Verb Identity x Native Language x Verb Class	1,76	5.546*	.012	1,62	2.748	.037
Prime x Native Language x Verb Class	1,76	.437	.060	1,62	2.142	.018
Verb Identity x Native Language	1,76	.131	.012	1,62	.045	.037
Verb Identity x Verb Class	1,76	.021	.012	1,62	.005	.027
Prime x Verb Identity x Native Language	1,76	1.412	.014	1,62	1.734	.018

Table 7-3: Statistical results of 4-way ANOVAs on the lenient scores, with Language Proficiency, Prime and Verb as factors.

Interpreting a four-way ANOVA is a complicated task. I therefore begin by addressing the effects which did not involve the Native Language factor, thus reflecting overall tendencies across all participants, before looking at the effects involving Native Language. I then present separate analyses of the L1 and L2 participant data. Finally, I compare the behaviour of the L1 and L2 speakers directly, firstly for the unergative verbs and then for the unaccusative verbs.

7.4.1 Overall effects across all participants

Overall there was a significant effect of Prime: Participants used 26% more VS structures following a VS compared to an SV prime. This priming effect was modified by a significant interaction with Verb Identity: the tendency to use VS structures after a VS compared to SV prime was stronger when the verb was repeated across prime and target (33%) than when it was different (19%). This reflects a lexical boost to priming. Planned comparisons showed that the effect of prime was significant both when the verb was the same ($t(79)=9.255$, $p<.001$; $t(63)=12.052$, $p<.001$) and when it was different ($t(79)=6.804$, $p<.001$; $t(63)=7.336$, $p<.001$). There was also main effect of Verb Identity: more VS structures were produced when the verb was the same compared to when it was different. As Figure 7-3 shows, this can likely be attributed to the large lexical boost in the VS prime conditions, because there is little effect of Verb Identity on the SV prime conditions.

I found a main effect of Verb Class: VS word order was 21% more common with unaccusative than unergative verbs overall. This shows that lexical properties can influence production, because Spanish speakers (L1 and L2 combined) produced more VS word order with unaccusatives than unergatives.

The magnitude of priming seen was also different across the two verb types, as indicated by an interaction of Prime and Verb Class. When the verb was unaccusative, participants were 33% more likely to use a VS structure after a VS than an SV prime; when the verb was unergative this likelihood reduced to 19%. Planned comparisons showed the priming effect to be significant both for the unergative verbs ($t(39)=4.888$, $p<.001$; $t(31)=7.802$, $p<.001$) and the unaccusative verbs ($t(39)=8.073$, $p<.001$; $t(31)=13.410$, $p<.001$). Interestingly, there was no interaction of Prime, Verb Identity and Verb Class, suggesting that the lexical boost to priming was of similar magnitude for both verb classes.

7.4.2 Comparison of native vs. non-native speakers across all results

As can be seen from Table 7-3, several significant effects involved the factor Native Language, showing differences between the behaviour of the L1 and L2 speakers. A main effect of Native Language reflected that the L2 speakers produced 16% more VS

structures than the L1 speakers overall. The L2 speakers were also more susceptible to priming of VS structures than the L1 speakers: L2 speakers showed a 31.9% increase in VS structures following a VS compared to an SV prime, while the same figure for L1 speakers was 19.9% (reflected by an interaction of Prime and Native Language).

In addition, the difference in VS production between unaccusatives and unergatives appeared larger for the L1 speakers (17.9%) than for the L2 speakers (10.6%), as suggested by a marginal interaction of Verb Class with Native Language (significant by items only).

Finally, there was a four-way interaction of Prime, Verb Identity, Verb Class and Native Language (marginally significant by participants, significant by items), and a marginally significant interaction of Verb Identity, Verb Class and Native Language. No other effects reached significance.

In order to explore these interactions further, I then looked at the effects of the L1 and L2 participants separately.

7.4.3 Analysis on the L1 data

I performed three-factor ANOVAs on the L1 data, with the factors Verb Class (Unergative vs. Unaccusative), Prime (SV vs. VS), and Verb Identity (Same vs. Different) (Verb Class was a between-participants and between-items factor; Prime and Verb Identity were within-participant and within-items factors). Table 7-5 shows the results of the ANOVAs performed on this data. To help the reader in interpreting this analysis, Table 7-4 shows the data for the L1 participants only, and Figure 7-4 shows the same data in graphical format.

	SV / Same Verb	SV / Diff Verb	VS / Same Verb	VS / Diff Verb
Unergative	.03 (.02)	.00 (.00)	.14 (.06)	.10 (.05)
Unaccusative	.08 (.04)	.09 (.04)	.46 (.09)	.28 (.07)

Table 7-4: The proportion of VS structures produced in each condition by the L1 speakers in Experiment 5 (standard error in brackets).

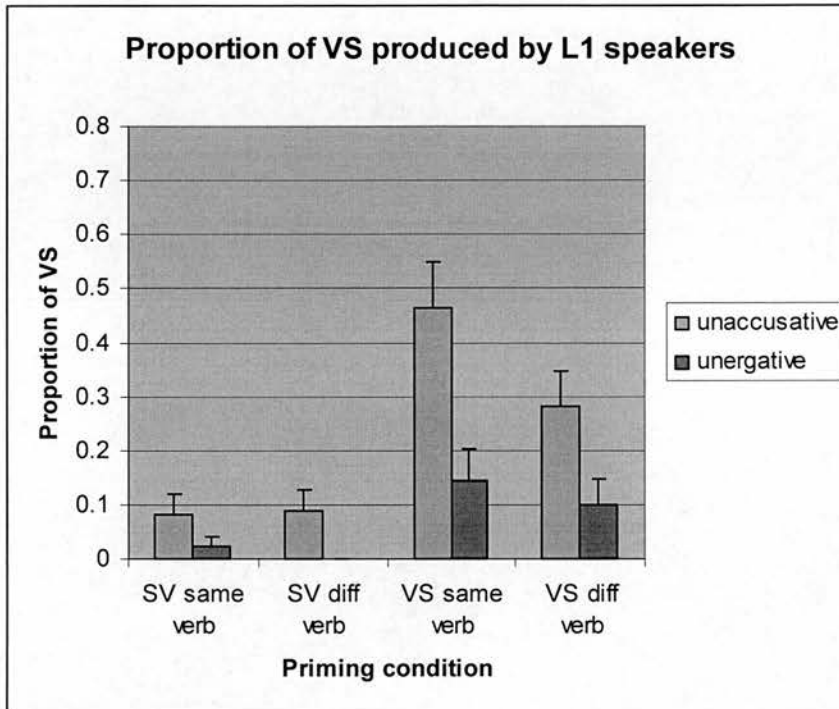


Figure 7-4: The proportion of VS produced by the L1 speakers in Experiment 5 across all conditions. Bars represent standard error values.

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Prime	1,38	31.425***	.050	1,62	140.960***	.018
Prime x Verb Identity	1,38	10.098**	.011	1,62	7.249**	.023
Verb Class	1,38	7.777**	.135	1,62	110.044***	.015
Prime x Verb Class	1,38	6.337*	.050	1,62	27.736***	.018
Prime x Verb Identity x Verb Class	1,38	7.053*	.011	1,62	5.406*	.023
Verb Identity	1,38	21.220***	.007	1,62	11.182**	.019
Verb Identity x Verb Class	1,38	4.183*	.007	1,62	2.224	.019

Table 7-5: Statistical results of ANOVAs performed on the L1 data only.

The L1 analysis confirmed a main effect of Prime: Native speakers were 19.9% more likely to produce a VS structure after a VS prime than SV prime. There was also an interaction of Prime and Verb Identity, suggesting a lexical boost. Planned comparisons confirmed that priming was found both when there lexical overlap ($t(39)=5.179, p<.001$; $t(63)=8.030, p<.001$), and when there was no lexical overlap ($t(39)=4.370, p<.001$; $t(63)=6.032, p<.001$), but that priming was 10.4% stronger when the verb was repeated across prime and target (a lexical boost).

A main effect of Verb Class supported the finding that L1 speakers used 16.1% more VS word order overall with unaccusative verbs (22.9%) compared to unergative verbs (6.8%). Priming was also stronger for unaccusative verbs (28.8% more VS after VS than SV primes) than unergative verbs (10.9% more VS after VS than SV primes), confirmed by the significant interaction of Prime and Verb Class. However, priming was significant for both verb types (unergatives: $t(19)=2.411, p<.05$; $t(31)=7.802, p<.001$; unaccusatives: $t(19)=5.244, p<.001$; $t(31)=13.410, p<.001$).

There was also an interaction between Prime, Verb Identity and Verb Class, which I discuss further below, a main effect of Verb Identity, and an interaction of Verb Identity and Verb Class. No other effects reached significance.

7.4.3.1 L1 data: separate analyses by verb type

The interaction between Prime, Verb Identity and Verb Class suggested that the lexical boost effect was different across the two verb types. I explored this by performing two-way ANOVAs on the L1 data across the two levels of Verb Class separately, with factors Prime and Verb Identity (which were both within-participants and within-items factors). Table 7-6 shows the results of this analysis.

As can be seen in Table 7-6, for the unaccusative verbs there was both a significant priming effect and a lexical boost to priming (as shown by a main effect of Prime and interaction of Prime and Verb Identity). For the unergative verbs there was a main effect of Prime but no other significant effects, suggesting that the priming effect was the same regardless of whether the verb was repeated across prime and target. This could simply be a floor effect, because so few VS word orders were produced overall (6.6%). Indeed, there was a trend for L1 speakers to show a lexical boost, with an average

of 4% more VS when the target repeated the prime verb than when it did not. Alternatively, it could reflect the lack of specific primable links between unergative verbs and a representation of VS word order. However, these results confirm that the interaction between Prime, Verb Identity and Verb Class reflected a stronger lexical boost effect with unaccusative compared to unergative verbs.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Unaccusatives						
Prime	1,19	27.833***	.060	1,31	109.680***	.025
Prime x Verb Identity	1,19	14.027**	.013	1,31	7.554*	.039
Verb Identity	1,19	18.870***	.008	1,31	7.927**	.028
Unergatives						
Prime	1,19	5.855*	.041	1,31	33.018***	.012
Prime x Verb Identity	1,19	.173	.008	1,31	.202	.008
Verb Identity	1,19	3.963 (p=.061)	.006	1,31	3.267 (p=.080)	.010

Table 7-6: Results of ANOVAs looking at the L1 data separately for the unaccusative and unergative verbs.

7.4.4 Analysis on the L2 data

I performed an identical ANOVA analysis as described in section 7.4.3 but on the L2 speakers. The results of ANOVAs performed on these data can be seen in Table 7-8. To help the reader in interpreting this analysis, Table 7-7 shows the data for the L2 participants only, and Figure 7-5 shows the same data in graphical format.

	SV / Same Verb	SV / Diff Verb	VS / Same Verb	VS / Diff Verb
Unergative	.04 (.02)	.04 (.02)	.39 (.07)	.22 (.07)
Unaccusative	.23 (.07)	.28 (.07)	.68 (.08)	.58 (.07)

Table 7-7: The proportion of VS structures produced in each condition by the L2 speakers in Experiment 5 (standard error in brackets).

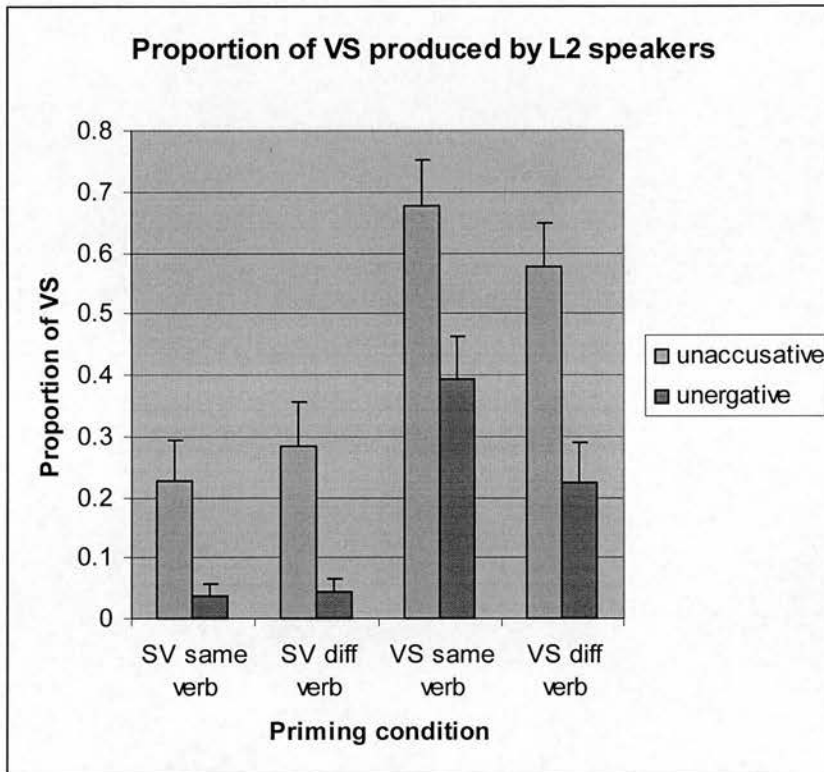


Figure 7-5: The proportion of VS produced by the L1 speakers in Experiment 5 across all conditions. Bars represent standard error values.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,38	58.284***	.070	1,62	170.135***	.038
Prime x Verb Identity	1,38	16.161***	.017	1,62	11.753**	.038
Verb Class	1,38	13.733**	.207	1,62	174.168***	.026
Prime x Verb Class	1,38	1.606	.070	1,62	4.964*	.038
Prime x Verb Identity x Verb Class	1,38	.053	.017	1,62	.055	.038
Verb Identity	1,38	6.395*	.017	1,62	3.599 (p=.062)	.045
Verb Identity x Verb Class	1,38	2.206	.017	1,62	1.096	.045

Table 7-8: Statistical results of ANOVAs performed on the L2 data only.

The L2 speakers were 32.8% more likely to use a VS structure after a VS than SV prime (main effect of Prime), and this tendency was boosted when the verb was repeated across priming and target (Prime and Verb Identity). Planned comparisons confirmed that priming occurred both in the presence ($t(39)=8.204, p<.001$; $t(63)=11.710, p<.001$) and absence ($t(39)=5.310, p<.001$; $t(63)=6.631, p<.001$) of lexical overlap, but was 16.6% stronger when the verb was repeated.

There was a main effect of Verb Class, reflecting that the L2 speakers used 26% more VS structures with unaccusative verbs compared to with unergatives. This shows sensitivity to the word order preferences of the two types of verbs. However, in contrast to the L1 group, there was only a marginal difference in priming for unaccusatives vs. unergatives (interaction of Prime and Verb Class significant by items only) and no difference in the size of the lexical boost with the two verb classes (no interaction of Prime, Verb Identity and Verb Class).

7.4.4.1 L2 data: separate analyses by verb type

As with the L1 speakers, I also performed separate ANOVAs on each level of Verb Class, with factors Prime and Verb Identity (both within-participants and within-items factors). See Table 7-9 for the results of this analysis.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Unaccusatives						
Prime	1,19	37.852***	.073	1,31	119.425***	.037
Prime x Verb Identity	1,19	6.957*	.018	1,31	4.713*	.041
Verb Identity	1,19	.380	.024	1,31	.328	.050
Unergatives						
Prime	1,19	21.263***	.067	1,31	57.141***	.039
Prime x Verb Identity	1,19	9.334**	.016	1,31	7.307*	.034
Verb Identity	1,19	14.202**	.009	1,31	4.8348	.041

Table 7-9: Results of ANOVAs looking at the L2 data separately for the unaccusative and unergative verbs.

This analysis was to ensure that both priming and a lexical boost were found with both class of verb. Table 7-9 clearly shows a significant L2 priming effect both when the verbs were unaccusative and when they were unergative (main effect of Prime). Planned comparisons confirmed that priming occurred both in the presence of lexical overlap (unergatives: $t(19)=5.06$, $p<.001$; $t(31)=6.73$, $p<.001$; unaccusatives: $t(19)=6.55$, $p<.001$; $t(31)=10.4$, $p<.001$) and absence of lexical overlap (unergatives: $t(19)=3.05$, $p<.01$; $t(31)=4.05$, $p<.001$; unaccusatives: $t(19)=4.46$, $p<.001$; $t(31)=5.28$, $p<.001$). There was also a lexical boost to priming, as indicated by the interaction of Prime and Verb Identity and confirmed by performing planned comparisons between the amount of priming in the same and different verb conditions (unergatives: $t(19)=2.27$, $p<.05$; $t(31)=2.74$, $p<.05$; unaccusatives: $t(19)=2.60$, $p<.05$; $t(31)=2.70$, $p<.05$). In the next section I directly compare the magnitude of priming and lexical boost across L1 and L2 speakers, considering unergative and unaccusative verbs separately.

7.4.5 Comparisons of L1 and L2 effects over each type of Verb Class

Section 7.4.1 reported interactions of Native Language, Prime and Verb Class, and of Native Language, Prime, Verb Identity and Verb Class. These suggested that the relative magnitude of L1 and L2 priming and lexical boost differed depending on the Verb Class involved. In order to explore this further, I performed planned comparisons separately across each level of Verb Class.

I computed a measure of overall priming for both the L1 and L2 speakers, by subtracting the total VS responses produced after SV primes from the VS responses produced after VS primes, and dividing this by the total number of SV and VS responses across the experiment. I also computed a measure of the overall lexical boost for the L1 and L2 speakers in each verb class, by subtracting the different-verb priming from the same-verb priming.

With unaccusative verbs, the L2 speakers showed a 37.4% priming effect and a 15.7% lexical boost to priming. The L1 speakers showed a 28.8% priming effect and a 19% lexical boost. Planned comparisons (independent by participants and paired by items) showed that the lexical boost effect was not significantly different across the L1 and L2 speakers ($ts<.07$), and that the overall priming was only marginally different

across the two language groups (significant by items only; $t_1(38)=1.01$, $p=.30$; $t_2(31)=2.17$, $p<.05$)

With unergative verbs, the L2 speakers showed a 28.2% priming effect and a 17.6% lexical boost to priming. In contrast, the L1 speakers showed a 10.9% priming effect and only a 1.7% lexical boost. Planned comparisons (independent by participants and paired by items) confirmed that the L2 speakers showed significantly more priming than the L1 speakers ($t_1(38)=2.28$, $p<.05$; $t_2(31)=5.13$, $p<.001$), and a significantly stronger lexical boost to priming ($t_1(38)=2.25$, $p<.05$; $t_2(31)=2.17$, $p<.05$).

7.4.6 Developmental effects in the L2 participants

All the L2 participants who took part spoke at least an intermediate level of Spanish. Because Experiments 1 and 2 showed no difference in priming effects across different proficiencies, I did not recruit participants with the intention of comparing effects across proficiencies. However, I did perform some analyses on the data looking for any developmental trend in the L2 priming effects.

I carried out Rho correlation analyses to look for any significant relationship between individuals' proficiency in Spanish (Cloze test score) and various measures of the amount of priming in the L2 speakers (Same-verb priming, Different-verb priming, Overall priming, and Lexical boost, see section 3.7.4). Given the lack of developmental effects found in the previous experiments described in the thesis, I did not predict a direction of effect and so performed two-tailed tests

I firstly performed these analyses on the unaccusative and unergative data combined. However, none of the analyses even approached significance (Same-verb priming: $N=40$, $r=-.086$, $p=.599$; Different-verb priming: $N=40$, $r=.004$, $p=.979$; Overall priming: $N=40$, $r=-.011$, $p=.944$; Lexical boost: $N=40$, $r=.039$, $p=.811$), thus I found no relationship between L2 proficiency and observed priming effects. I also looked for a correlation between score on Cloze test and overall proportion of VS produced by participants, but this similarly produced no significant relationship ($N=40$, $r=.158$, $p=.329$).

I then divided the L2 groups in two according to whether they had seen unaccusative or unergative verbs, and performed the same correlational analyses on these

two groups separately. For the unergative data, none of the analyses approached significance (Same-verb priming: $N=20$, $r=-.042$, $p=.861$; Different-verb priming: $N=20$, $r=.053$, $p=.825$; Overall priming: $N=20$, $r=.032$, $p=.894$; Lexical boost: $N=20$, $r=-.094$, $p=.693$). I also looked for a correlation between score on Cloze test and overall proportion of VS produced by participants, but this similarly produced no significant relationship ($N=20$, $r=-.008$, $p=.973$).

For the unaccusative data, no relationship was found between score on Cloze test, and the magnitude of priming found (Same-verb priming: $N=20$, $r=-.255$, $p=.277$; Different-verb priming: $N=20$, $r=-.215$, $p=.363$; Overall priming: $N=20$, $r=-.214$, $p=.363$; Lexical boost: $N=20$, $r=-.010$, $p=.967$). The only result approaching significance was the correlation between proficiency and overall proportion of VS produced by participants ($N=20$, $r=.377$, $p=.101$, under a 1-tailed analysis this would be $p=.050$). This is in keeping with previous studies which show that L2 speakers of Spanish produce more VS structures with unaccusatives as proficiency increases.

7.4.7 Summary of results

In sum, these analyses confirm several of the predictions from the introduction. There was a significant priming effect on word order in Spanish in both L1 and L2 speakers: participants were more likely to produce a VS structure after a VS prime than after an SV prime. This effect held even when there was no lexical overlap between the prime and target, but the effect was stronger when the verb was repeated from prime to target, both for unergative and unaccusatives.

In addition, all participants produced more VS structure using unaccusative verbs than unergative verbs. However, there were key differences in the treatment of unaccusatives vs. unergatives by the native and non-native speakers.

The L1 speakers showed stronger priming and a stronger lexical boost with the unaccusative than unergative verbs. Indeed, they showed no lexical boost when the prime and target used the same unergative verb. In contrast, the L2 speakers showed only marginally stronger priming with the unaccusative than unergative verbs, and the lexical boost to priming was the same regardless of verb type.

Finally, although the L2 speakers showed stronger priming than the L1 speakers overall, a more detailed analysis showed that this was only the case when the prime and target used unergative verbs. When the experimental verbs were unaccusatives, there was no significant difference in priming and lexical boost between L1 and L2 speakers.

7.5 Discussion

A primary aim of Experiment 5 was to investigate word order production in L2 speakers using syntactic priming, and to compare this to effects in L1 speakers. In addition, Experiment 4 had shown off-line preferences in L1 Spanish speakers for different word orders with two categories of intransitive verbs; in contrast, L2 Spanish speakers had not shown this effect. Experiment 5 therefore addressed whether these preferences would affect production, and how this might differ in L1 and L2 speakers.

I begin this discussion by addressing the implications of word order priming and a lexical boost in L1 and L2 speakers, before focusing on the effects of intransitive verb class in production. I then discuss how pragmatic effects might play a role in the word order effects observed, and also tackle whether the current findings can contribute to the debate on whether split intransitivity is based on semantic or syntactic differences across verbs. Finally, I look at what implications the current results have for the architecture of the language production system, which must account for the finding that lexical factors influence word order processing.

7.5.1 Word order priming and lexical boost in L1 and L2 speakers

Experiment 5 successfully demonstrated word order priming using syntactic options that have not previously been examined using priming – the alternation in order of a single subject NP and an intransitive verb. This therefore adds to previous findings of word order priming, and could be argued to be an example of sentence priming at the most basic level, involving only a verb and an NP.

The finding of priming in both L1 and L2 speakers in the absence of lexical overlap across prime and target suggests that L2 production of linear order was similar to that in L1 speakers, and that both involved the persistence of a syntactic frame

representing that word order³¹. One of the primed word orders – bare VS structure – was not a viable option in the L2 speakers' L1, English. This demonstrates that the L2 speakers had acquired a new word order and processed it in a similar manner to L1 speakers, analogous to the finding from Experiment 3 that L1 Spanish-L2 English speakers had acquired the DO structure in their L2.

An additional finding was that priming of word order in both L1 and L2 speakers was boosted when head of the phrase was repeated across prime and target in both L1 and L2 speakers. A lexical boost to priming has not previously been demonstrated in persistence of word order. With respect to priming of transitive and dative structures, the boost is proposed to reflect the existence of links between lexical representations and syntactic possibilities (e.g., Pickering & Branigan, 1998). These links are then assumed to be strengthened during the priming process through co-activation of the verb and syntactic structure. Finding the lexical boost in the current experiment therefore suggests that representations that specify word order are associated with specific lexical items, in the same way as other syntactic structures.

These findings can be explained under an account of syntactic priming stating that it reflects the primed speaker possessing some abstract representation of the primed structure (e.g., Pickering & Branigan, 1998; Branigan et al., 2000; Hartsuiker et al., 2004). Alternative approaches interpret syntactic persistence as the priming of the *processes* involved in mapping conceptual elements into linguistically coded sentence structures (e.g., Chang et al., 2000). However, this explanation cannot account for cross-modal priming, from comprehension to production, because presumably different processes are involved in parsing an incoming sentences and producing an outgoing sentence (e.g., Branigan et al., 2000). How can we explain the finding in L1 speakers that priming and a lexical boost were stronger with unaccusative verbs than unergative verbs (indeed, no lexical boost was found with the unergatives)? A plausible explanation is that there is a stronger link between unaccusatives and a representation of the VS structure

³¹ The observed effect could be argued to reflect priming at a conceptual level, not a word order level, because different word orders also carry different topic-comment structures (e.g., Hartsuiker & Kolk, 1998a; Hartsuiker, Kolk & Huiskamp, 1999). I return to this issue in Chapter 8.

than between unergatives and this structure. The stronger link leads to both stronger priming and lexical boost.

7.5.2 Split intransitivity effects in L1 and L2 production

I now turn to the effects of Experiment 5 relating to the split intransitive verb groups. Experiment 4 showed that L1 speakers of Spanish preferred SV order with unergatives and VS with unaccusatives in comprehension. In contrast, the L2 speakers had no overall lexically-dependent preferences for word order, suggesting that preferences were both more variable across individuals and more unstable within individuals. In addition, previous studies have shown L2 speakers of Spanish (L1 English) to be less sensitive to the word order associations of intransitive verbs, and to overgeneralise VS order to unergatives.

Experiment 5 mirrored these preferences in production in several ways. Firstly, more VS structures were produced overall with unaccusative than with unergative verbs, adding further evidence for the split in word order preferences across these verbs. Interestingly, the L2 speakers did produce more VS order overall with unaccusative than unergative verbs, indicating that at some level they were aware of the verb-class distinction and associated word order preferences. Although Experiment 4 did not show any L2 sensitivity to this, there is plenty of evidence in the literature that L2 learners are sensitive to the distinction between unergative and unaccusative verbs (e.g., Montrul, 2001, 2004, 2005; Oshita, 2001; Sorace, 1993, 1995; Sorace & Shomura, 2001).

Secondly, in the native speakers, there was also an influence of lexical class on strength of syntactic priming, and the lexical boost to priming. L1 priming was stronger when the verb used was unaccusative than when it was unergative, and the boost conferred to priming by the repetition of verb across prime and target was larger with unaccusative than unergative verbs. Indeed, in the conditions of no lexical overlap, the L1 speakers did not show a significant lexical boost with the unergative verbs but showed a 19% lexical boost to priming with the unaccusative verbs. In contrast, in the L2 speakers neither the magnitude of priming nor that of the lexical boost were influenced by which verb-class the head verb belonged to: the effects were of a similar size for both unaccusative and unergative verbs.

The pattern of results suggest that while L2 production of word order shows broad similarities to that in L1 speakers, L2 speakers do not behave like native speakers with respect to lexical effects in processing in production. The L1 architecture appears to incorporate knowledge about the relative acceptability of intransitive verbs with different word orders, for example in the strength of the links between lemmas word order representations. This knowledge then determines how susceptible the L1 speakers will be to priming in a particular context. In contrast, the L2 speakers appear to have less stable knowledge about lexical constraints on which word order option is appropriate in Spanish. They are not able to apply native-like knowledge about VS structures being infelicitous with unergatives in a neutral context, and are therefore more susceptible to priming from the preceding context where the L1 architecture resists this influence.

These results fit well with my argument based on Experiments 1-3 that differences in L1 and L2 syntactic production appear in contexts in which L1 speakers disprefer a particular syntactic option and therefore resist priming, while L2 speakers are less sensitive to this dispreference. In Experiments 1 and 2, the dispreferred structure was the Spanish passive. In Experiment 5 the dispreferred factor is not a structure in general, but rather the association of an unergative verb with VS order, and this leads to less priming and a lack of lexical boost in L1 speakers.

The L1-L2 differences also fit well with linguistic findings that L2 speakers are particularly vulnerable to optionality at interfaces (e.g., Sorace, 2003, 2005), where two sources of knowledge must be combined to create an appropriate, native-like utterance. In this case the knowledge sources which must be integrated are syntactic rules about which word orders are available, and information from the lexicon about the semantics/syntax of the verb. It is not enough for the L2 speakers to know which grammatical structures are available in Spanish, but they must also know the lexical restrictions on which structure is felicitous in a context. Interface conditions are particularly problematic for L2 speakers to acquire, and constitute linguistic aspects where even very advanced L2 speakers continue to demonstrate non-nativelike behaviour (e.g., Sorace, 2003, 2004, 2005).

7.5.3 A brief word on pragmatics

I now mention another factor known to influence word order in Spanish, aside from verb class: pragmatic-discourse factors. As mentioned earlier in this thesis, both SV and VS are felicitous word order options with any verb, if the pragmatic context licenses this. Indeed, VS word order is strongly preferred with unergatives when there is a focus on the subject argument. However, L2 learners remain insensitive to focus effects on word order even at high proficiencies, even when they do show some level of sensitivity to the influence of lexical factors (Hertel, 2003; Lozano, 2003, 2006).

In the current study, I was primarily interested in verb-class influence on word order. I therefore intended that participants treat each picture as a new context; the pictures presented were largely unrelated to one another, although similar objects or words were used across pictures. Participants were not instructed to draw a continuous discourse interpretation of these pictures. Indeed, previous work on picture-description tasks has suggested that participants approach each new picture as a new context, as shown by a tendency to repeat the indefinite article when describing the same picture several times (e.g., continuing to say *a dog* instead of *the dog*, even when the same dog has appeared in several pictures: Holly Branigan, personal communication).

Therefore, I intended each picture to be described in an ‘out of the blue’ context. However, this did not directly control the pragmatic context individual speakers might have applied to the pictures, and this could in turn influence the word order produced. A key example of where pragmatic factors might have influenced target picture descriptions is when the verb was repeated across prime and target. In this sense, the verb could be treated as old information, and the subject argument as new, focused information. Therefore, regardless of the word order in the prime, participants might show a tendency to produce VS word order in a same-verb condition (focusing the subject). There is some support for this in the L1 speakers’ descriptions following an unergative, SV prime in the same-verb condition. The combination of a priming effect and the use of an unergative verb strongly predicts production of SV targets, while a pragmatic effect predicts a VS target. Interestingly, more VS structures were produced by the L1 speakers in this condition (3%) than in the different-verb SV condition (0%), suggesting a weak

pragmatic effect. The L2 speakers, in contrast, show no difference in the proportion of VS structures produced with unergatives after an SV and VS prime (both 4%). However, these figures are very small and it is difficult to draw any strong conclusions.

In general, the results produced effects that were predicted by verb-class influences on language production. Therefore, even if there was any influence of pragmatics on word order choices in this experiment, this was not strong enough to override the tendencies related to lexical preferences.

7.5.4 Is split intransitivity grounded in semantic or syntactic differences?

We have seen that different theories of split intransitivity attribute the difference between unergative and unaccusative verbs to either semantic differences (e.g., Van Valin, 1990), syntactic differences (e.g., Burzio, 1986), or a combination of the two (e.g., Levin & Rappaport Hovav, 1995; Perlmutter, 1978; Sorace, 2000). However, it is not clear exactly how these different arguments would manifest themselves in language production, and only speculative predictions can be made. In psycholinguistic models of production, both semantic and syntactic characteristics are assumed to be represented at the lemma level (Levelt, 1989), and thus semantic and syntactic information is highly integrated and available at the same level of processing. Activation of a concept at the conceptual level is assumed to feed forward to activate lemma representations. Once a lemma is selected, all the syntactic information associated with that lemma becomes available.

The semantic vs. syntactic debate therefore makes less sense in the context of psycholinguistic models of production. One speculative prediction could be that if the distinction between intransitive verbs is syntactic, the representations and processes involved in producing SV or VS word order would be different depending on the verb involved. In contrast, if the distinction is semantic, similar syntactic representations and processes can be implemented for both verb classes. However, on the basis of the current study I cannot distinguish between the different accounts of split intransitivity, and I return to the issue in Chapter 8.

7.5.5 Implications of the results for models of language production

I now briefly discuss the implications of the current results for models of language production, and how they can cast light on the architecture of the production system at the level of word order. As mentioned in the introduction to this chapter, there has previously been little evidence for lexical factors playing a role in word order production and models vary as to whether they can account for the finding that lexical factors affect word order production. I will now discuss the implications of the findings for production models with respect to two different aspects. Firstly, whether hierarchical and linear aspects of a constituent structure are specified in one stage or in two separate stages. Secondly, whether semantic and syntactic information, as embodied by the lemma, is still available at the level of positional processing.

Previous studies on word order priming interpret the priming effect as evidence for the existence of a stage in language production during which linear word order is computed, separate from and subsequent to the specification of hierarchical structure (Hartsuiker, Kolk & Huiskamp, 1999; Hartsuiker & Westenberg, 2000; see also Vigliocco & Nicol, 1998). In line with theories of phrase structure grammar (e.g., Pollard & Sag, 1994), the processor is assumed to construct two representations in producing the final constituent structure. Initially, a phrase-structure representation is computed, which is specified for dominance and functional relations but not linear order. This then serves as the input to a process of linearization, during which linear word order is imposed on phrasal structures.

However, word order priming is equally compatible with a model of production in which hierarchical structure and linear word order are specified at the same time (e.g., Bock & Loebell, 1990; Pickering, Branigan & McClean, 2002). Indeed, there is some evidence against a 'two-stage' model. As discussed in Chapter 2, Pickering, et al. (2002) failed to find priming from NP-shifted datives to PO datives. Under a two-stage argument, these structures should share the same intermediate, unordered representation after the first stage, and so the one should prime the other. Pickering et al. concluded that phrasal structure and linear word order are fixed at the same stage (2002).

A further way to address the one- and two-stage models is to argue that if two structural aspects are specified simultaneously, then the same factors should be able to

influence both processes. In contrast, if the two processes occur at different stages, as Hartsuiker and his colleagues would claim, the factors influencing the two may be different. In addition, if the two stages are assumed to be discrete, the factors which influence the first stage should not be available for processing in the second stage. The data presented in Experiment 5 shows that word order processing is susceptible to a lexical boost, as has been shown in priming of hierarchical structures (e.g., Experiments 1 & 2, this thesis; Branigan et al., 2000; Pickering & Branigan, 1998). In addition, Experiments 4 and 5 together show that the specific properties of a verb can influence choice of word order, as has been shown for structures which differ in hierarchical structure (e.g., F. Ferreira, 1994; V.S. Ferreira, 1996). Because the two structural aspects are susceptible to the same influences, a parsimonious account would say they are specified at the same stage.

The finding that lexical factors can influence word order production suggests an underlying association between an abstract representation of the word order options (SV vs. VS) being primed and the lexical items involved, as has been suggested for phrasal syntactic structures (Branigan et al., 2000; Cleland & Pickering, 2003; Pickering & Branigan, 1998). The lexical boost shows, firstly, that there is overlap in the factors influencing the specification of hierarchical structure and word order, a finding parsimoniously explained by a one-stage model of building constituent structure. Secondly, we have seen that lexical processing is still occurring at the stage where word order is computed, which again is most easily explained with a one-stage model. However, a two-stage model can still account for the data if we assume that semantic and syntactic aspects of individual lexical items remain available throughout positional processing.

The current data can also contribute to specifications in production models with respect to the distinction between functional and positional processing, (Bock, 1987; Bock & Levelt, 1994; Bock, Loebell & Morey, 1992). Within these models, there is no order imposed during functional processing, and so both the hierarchy and linear word order are set during positional processing. However, it is clear that the basic features of the hierarchical aspects of the frame are largely predictable from the grammatical roles assigned and syntactic features of the selected lemmas (Bock & Levelt, 1994). For

example, the distinction between an active and a passive structure can be described as a difference in grammatical role assignment, but this directly determines a difference in hierarchical structure. Function assignment is clearly sensitive to the characteristics of lexical items, as shown by the studies mentioned in Chapter 2 (Section 2.4.4). Indeed, function assignment occurs at the same level in processing as lemma selection, at which stage semantic and syntactic information about a word is available. However, the specification of serial order is located at the positional level and in such models is assumed to be insensitive to the meaning of lexical items, and sensitive only to phonological aspects (Bock, Loebell & Morey, 1992).

The findings of Experiment 5 show that the semantic and/or syntactic properties of lexical items *can* influence positional processing however, because unaccusative and unergative verbs vary in their semantics and the thematic roles they select for (as well as, by some linguistic theories, their syntactic properties), and this influences word order production. This could be explained by allowing positional processing mechanisms access to lexical processing (e.g., by cascading information from the conceptual and lemma levels, to the positional level). However, alternative models of language production can account for the data more simply, because they allow lexical factors to impact upon both grammatical function assignment and word order directly (e.g., Kempen & Hoenkamp, 1987; Levelt, 1989). For example, Kempen and Hoenkamp assign the mechanisms for computing word order to a stage that encompasses both grammatical role assignment and lexical processing.

The discussion of how a model of language production will ultimately account best for all the data available is still to be resolved. My contribution from this study is that ultimately the model must allow word order specification to be susceptible to specific lexical factors other than phonological properties.

7.6 Comparison of L1 preferences in Experiment 4 with effects in Experiment 5

Before concluding this chapter, I present a final analysis which compares the L1 data from Experiment 5 with the L1 data from Experiment 4. The intention was to investigate whether the difference in L1 priming across unergative and unaccusative verbs reflected two discrete verb categories, or a continuum of behaviour whereby the more acceptable a

particular verb is with VS word order, the more priming and the greater a lexical boost is observed³².

Experiment 4 showed that although overall differences were seen between unaccusatives and unergatives, the word order preferences did not form two discrete groups but might be better regarded as a continuum: some verbs strongly preferred SV and others strongly preferred VS, with some overlap between the two classes in the middle. I therefore performed an analysis on the data from Experiment 5 in a verb-specific manner and not by collapsing the verbs into two groups. Specifically, I looked for a relationship between the L1 word order preferences found in Experiment 4 and the L1 priming results found in Experiments 5 for individual verbs.

7.6.1 Correlation of Experiment 4 preferences with Experiment 5 effects

For each of the 16 verbs used in Experiment 5 I calculated means for the following measures (by taking the mean values of the four *target* items involving that verb)³³: Overall VS priming, Same-verb VS priming, Different-verb VS priming, and Lexical boost (see Section 3.7.4). I also calculated the proportion of VS structures produced overall. I paired each of these with the mean preference rating for the target verb in Experiment 4 ('Target-preference'). I then performed correlation analyses on these pairings, predicting a positive correlation between VS preference and both priming magnitude and lexical boost.

Because there were only 16 items, I used a non-parametric Spearman's Rho correlation analysis. This was one-tailed because of the predicted direction of effects. The results showed a significant relationship between Overall priming and Target-preference ($n=16$, $r=.567$, $p<.05$), supporting that when VS is more acceptable with a particular verb there is a stronger priming effect for targets using that verb. In addition, there was a significant correlation between Same-verb priming and Target-preference ($n=16$, $r=.597$, $p<.01$). However, there was no correlation between Different-verb priming and Target-

³² I performed this analysis only on the L1 data, because the L2 speakers showed no consistent word order preferences in Experiment 4. In addition, different participants were used in the two studies, and L2 speakers' preferences are seen to be variable both within and between individuals. Therefore, finding any correlation would be very unlikely.

³³ I also performed the same correlation analyses treating each of the 64 target items individually, instead of taking a mean measure across the items. The results were identical to those reported above, therefore I will not report them.

preference ($n=16$, $r=.088$, $p=.37$). This suggests that the effect of Target-preference on priming emerges only when the prime used the same verb as the target. Finally, there was a significant relationship between Target-preference and both the size of the Lexical boost ($n=16$, $r=.609$, $p<.01$), and overall proportion of VS produced ($n=16$, $r=.703$, $p<.01$).

One explanation for the lack of correlation between Target-preference and different-verb priming may be that several items showed zero priming in the different-verb condition. The level of priming may therefore not be high enough to observe a correlational effect. In contrast, in the same-verb condition the amount of priming in general was larger, allowing more opportunity to find verb-dependent effects.

I selected a subset of items for which at least some priming was found in the different-verb condition. Of the 64 items (prime-target pairings) from Experiment 5, I excluded 27 items consisting of 18 unergative items and 9 unaccusative items for which the different-verb VS priming was 0. This left 37 items. I performed a correlation analysis between the proportion of different-verb priming found for these items and the Target-preference. This analysis still produced no significant effect ($n=37$, $r=.039$, $p=.409$).

So, despite the fact that Experiments 4 and 5 used different participants, I was able to find a significant correlation between the VS preferences observed in the former and various effects observed in the latter, although not in the amount of different-verb priming.

An important issue this raises is the question of the locus of the differences between the intransitive verb class behaviour. Does it lie in the preference of the verb used in the *prime*, or the preference of the verb used in the *target*? The above correlations looked at the VS preferences of the verbs used in the targets of Experiment 5, but only found a correlation between Target-preference and priming magnitude in the same-verb condition. Obviously the prime and target in this condition use the same verb. Thus, the significant correlation could stem from preferences of the verb used in the prime, verb used in the target, or the fact that the two are the same. In the different verb condition, the VS preference of the prime verb bears no relation to that of the target verb except that they come from the same intransitive verb class.

I investigated this further by looking for a correlation between the VS preference of the *prime* verb with the Different-verb priming effect. For the 64 prime items I paired the VS-preference score for the verb used in that prime with the priming produced in the different-verb condition with that prime. Results showed no significant Pearson's correlation between different verb priming and the prime-verb preference for VS ($n=16$, $r=.071$, $p=.396$)³⁴, even when I only considered the 37 items for which some priming was found ($n=37$, $r=.008$, $p=.481$).

7.6.2 Discussion of correlation analyses

The results of these correlation analyses showed that the magnitude of same-verb priming was positively correlated with the VS preference L1 speakers had for the verb involved. In this case, both the prime and target used the same verb. There is therefore some linear relationship between preference for a particular structure with a particular verb, and how susceptible speakers are to priming in the production of sentences using that verb. It may be more sensible therefore to think of the word order preferences of unaccusative and unergative verbs as lying along a continuum as opposed to constituting two discrete groups.

From the questionnaire data collected in Experiment 4 it was clear that word order preferences vary across individuals. It may therefore be that the preferences of an individual speaker determine the susceptibility of that speaker to priming. However, the preference scores used in these correlation were the average rating from 18 different participants, and these were different participants to those who took part in the priming study. It could therefore be argued that the ratings I collected do not reflect the preferences of the individuals in the priming study. However, I can conclude that the preference scores do reflect a general population trend also found in the priming study participants, firstly, because there was a significant correlation between same-verb priming and preference scores, and secondly because I also found strong correlations between preference scores and the proportion of total VS structures produced, as opposed to any change in these proportions dependent on the prime.

³⁴ As with the correlations involving the target-verb ratings, I also did an analysis treating each of the 64 prime items individually, but this still produced no significant correlation.

The results of the correlation analyses fit with a conceptualisation of split intransitivity proposed by Sorace (2000), that intransitive verbs lie along a hierarchy dependent on their semantics, and that syntactic behaviour is affected by their position on the hierarchy. Preferences for a particular syntactic option vary more or less depending on the ‘coreness’ of the verbs (the core verbs lie at the extremes of the hierarchy, and show more consistent behaviour as a member of that class). Within this approach, the influence of intransitive verbs on priming may be considered not only in terms of two categories, but along a gradient whereby the stronger the preference for using VS with a verb, the larger the observed priming effect. However, the study was designed to compare L1 and L2 speakers across the two verb classes and not to specifically to address how more fine-grained semantic differences between intransitive verbs affects word order behaviour. Indeed, the verbs I chose were not what Sorace would term ‘peripheral verb’, but rather lie in homogenous classes as core unaccusative and (mostly) core unergative verbs, so variable behaviour is not expected. In addition, the hierarchy is not fine-grained enough to account for differences in the behaviour of verbs with very similar semantics (e.g., *arrive*, *come*, *enter* and *leave* would all be placed at the same, core unaccusative level in the hierarchy). This offers a direction for future research, in exploring the unaccusative semantic hierarchy and how this might influence priming.

7.7 Summary

This chapter addressed several issues. Firstly, having found similarities in the way L1 and L2 speakers process hierarchical syntactic structures in production (Experiments 1-3), I wanted to investigate word order processing in L1 and L2 speakers. Secondly, I wanted to investigate how the split between unergative and unaccusative intransitive verbs can influence word order production and syntactic priming in L1 and L2 speakers. This was of particular interest because Experiment 4 had shown L1 speakers to have clear word order preferences associated with different types of verbs, while L2 speakers are less sensitive to these preferences.

I presented an experiment looking at priming of word order in L1 and L2 Spanish speakers, using either unergative or unaccusative verbs. The results showed a novel word order priming effect (SV vs. VS structures) and a lexical boost to this effect, something

not previously shown in word order priming. Both L1 and L2 speakers produced more VS structures overall with unaccusative than unergative verbs, showing a sensitivity to the former being more appropriate in Spanish. In addition, for the L1 speakers, both VS priming and the lexical boost were stronger with the unaccusative verbs compared to the unergatives, which I explain as the use of VS order with unergatives being infelicitous, causing a resistance to priming. In contrast, the L2 speakers showed no difference in the priming and lexical boost. This shows a difference between native and non-native speakers in the strength of associations between lexical items and potential syntactic frames, specifically that L2 speakers lack knowledge about the felicity of syntactic options leading to overuse of inappropriate structures.

Finally, correlation analyses showed that the stronger L1 speakers' preference for VS structure, the stronger the priming observed, suggesting a direct relationship between the two which cannot be explained simply by the existence of two categorically distinct intransitive groups. However, I did not find a correlation between the different-verb priming with either the VS preference of the prime verb or of the target verb. This makes it difficult to conclude whether the same-verb effect is due to processing of the prime or the target, and indeed it may be a combination of the two.

8 Lexical constraints on syntactic production in Spanish

8.1 Overview

Experiment 5 demonstrated that both L1 and L2 speakers were more likely to produce VS word order when they had just read a sentence using VS than a sentence using SV word order. I explained this as a word order priming effect.

There are, however, two alternative explanations. One alternative is that what is being primed is not a linear word order representation, which would be shared across unergative and unaccusative verbs, but underlying syntactic representations or procedures that differ across the two types of verbs. This is based on linguistic theory that theorises the argument of unergatives and unaccusatives to be base-generated in subject and object position respectively. By this argument, VS word order has a different syntactic representation depending on which class of verb is involved, and this is created by different syntactic operations.

Another alternative explanation for the effect is that the primed factor is the topic-comment conceptual structure created by a particular word order. Again, this differs depending on the class of verb involved.

Both alternative explanations predict no (or attenuated) priming when the prime and verb come from different verb classes and therefore do not overlap in the crucial factor being primed. In this chapter I present a final experiment designed to explore these alternative explanations, using unaccusative and unergative prime constructions to prime unaccusative targets.

8.2 Introduction

Experiment 5 demonstrated that L1 and L2 speakers of Spanish were more likely to produce a VS structure after processing a VS structure than an SV structure. Following previous studies, I interpreted this as priming of linear word order (Hartsuiker, Kolk & Huiskamp, 1999; Hartsuiker & Westenberg, 2000). Because priming was found in the absence of lexical overlap between prime and target, this suggests the persisting structural representations are independent of specific verb lemmas. Furthermore, because word order priming shows a lexical boost, this suggests the existence of primable

associated between word order knowledge and specific lemmas, as proposed for phrasal-based combinatorial information (Hartsuiker et al., 2004; Pickering & Branigan, 1998). There were also important differences in the way L1 Spanish speakers treated the two types of verbs: VS priming was stronger when the prime and target used an unaccusative verb than an unergative. This could be explained by different strengths of links between the two types of verbs and word order representations determining susceptibility to priming. L2 speakers, however, showed equal priming and lexical boost for both types of verbs, suggesting the links between word order representations and intransitive verbs are equally as primable regardless of verb class.

There is, however, an alternative explanation for the priming effect observed, and the difference between the two verb groups. This stems from linguistic theories that explain split intransitivity in terms of different syntactic representations underlying unergative and unaccusative verbs (e.g., Burzio, 1986; Perlmutter, 1978; Zagana, 2002), which I mentioned in Chapter 2 but review here. An analogy is drawn between the single argument of unaccusative verbs and the complement of transitive verbs (Zagana, 2002). The argument of unaccusative verbs is initially assigned the grammatical role of object (i.e., it is base generated in object position), while the argument of unergative verbs is assigned the role of subject from the outset. To create SV word order, the argument of unergative verbs is already in subject position³⁵ but the argument of unaccusatives must be raised to subject position through a syntactic operation of movement. Likewise, the creation of VS word order is syntactically different depending on the verb: the argument of unergatives must undergo movement from base-generated structure, moving the external argument to a post-verbal position, whereas unaccusatives have a base-generated internal argument which maps directly onto VS order.

Under these accounts, producing SV or VS word order requires different syntactic operations to be applied depending on the verb involved. For this reason, VS order is dispreferred with unergatives in a neutral context, because a pragmatic factor is required to license the movement of the argument to post-verbal position; otherwise, movement is not licensed and the argument remains pre-verbal. Interestingly, this underlying

³⁵ Although, under some theories the subject in SV order is still hypothesized to be raised to a position of specifier of the IP, where it receives nominative case marking (Zubizarreta, 1998).

difference across intransitive verb types is assumed to be universal (i.e., an aspect of language innate to the human mind and common to all languages), so hypothesised to be found in English speakers as well as Spanish speakers. However, in English, there is no syntactic option to leave the subject in post-verbal position with unaccusative verbs³⁶ so there is compulsory raising of the underlying object to pre-verbal position. English speakers learning Spanish would therefore not need to acquire the verb classes themselves, but rather how these classes map onto word order in Spanish.

If base-generated structures and the syntactic operations acting on these structures to derive 'surface' structure are psychologically real, this would mean that the representations and processes acting on them in utterances involving unergatives and unaccusatives must be different. For example, an SV order with an unaccusative verb would contain a post-verbal trace of the original internal argument, while the same order with unergative verbs would not.

Therefore, linguistic theory claims differences in the syntactic structure of unergative and unaccusative verb phrases. It could therefore be argued that it is not linear word order representations that are primed, but these syntactic representations, which differ for the two verb types. In addition, the processes involved in constructing a particular word order will be different depending on verb involved. For example, VS word order with unaccusatives is assumed to be mapped directly from base-generated structures, while VS order with unergatives requires a syntactic operation to move the argument to postverbal position. Hence priming could also be explained in terms of the persistence of syntactic operations, such as the absence or presence of movement in producing a structure.

It is not entirely clear what these underlying structures would correspond to in psychological terms, or at what stage a syntactic operation of movement would be assumed to occur in production. However, the main point is that if we assume that the priming effect observed reflects something to do with these underlying structures (either persistence of representations, or movement operations), it differs across unergative and unaccusative verbs.

³⁶ An exception, as noted in Chapter 2, is when another constituent is present to be fronted, such as the locative phrase in *Into the room came my mother*, or in *there* constructions like *There arrived many students*.

Clear predictions can be made from the linear word order vs. different syntactic representations explanations of the priming effect. If what is primed is linear word order, then word order priming should still be possible in both L1 and L2 speakers even if the prime and target verbs are from different verb-classes. In contrast, according to the linguistic argument, an unergative verb used in VS word order would not prime VS order with an unaccusative verb, and vice versa, because of key differences between the syntax of the two verbs.

Is there any evidence for the psychological reality of movement? Several influential models of language production reject the idea of movement (or, in previous terms, 'transformations', Chomsky, 1981) in grammatical processing (e.g., Bock & Levelt, 1994; Bock, Loebell & Morey, 1992). For example, Bock & Levelt explicitly state that within grammatical encoding there is 'no level of processing at which the element that serves as the subject of the sentence plays a role that can be realized as a different grammatical relation' (1994, p.962). They argue that transformations add unnecessary processing complexity and that there is no evidence to support that grammatical-role assignments undergo changes. There is also evidence *against* the existence of transformations: Bock, Loebell & Morey (1992) used a sentence priming paradigm to address whether passive constructions exist as base-generated actives (undergoing movement to create the derived order of a theme-subject and agent-object). This was on the basis of linguistic theories like transformational grammar, which claimed the underlying structural roles played by the subject of an active and the object of a passive construction are the same at a deep-structure level. Results of Bock and colleagues priming study showed separate and independent effects of the structure being primed (active vs. passive priming) and the conceptual features of the subject and object of the structures. For example, participants were more likely to produce a structure with an inanimate derived subject when the prime used an inanimate derived subject, regardless of whether the sentences were active or passive. Bock et al. located these separate effects in positional and functional processing and rejected transformational (i.e., movement) effects, which predicted an association between the subject of an active and the object of a passive, not the subject of the passive.

Extending Bock et al.'s argument to the current issue, there should be no stage at which the argument of an unaccusative verb exists as a base-generated object, thus the same syntactic frame should be used for unergative and unaccusative verbs. Hence on the basis of Bock et al.'s findings, we would predict that priming should occur from sentences containing unergative verbs to sentences containing unaccusative verbs (and vice versa), because they are not 'base-generated' in different ways.

Experiment 6 addressed this issue directly by looking for priming when the prime and target used verbs from different classes.

8.3 Priming of topic-comment structure?

Another explanation for the priming effect found in Experiment 5 could be that it is not linear word order but a conceptual structure that is primed, based on the different topic and focus associated with different word orders. This has been put forward as a explanation for previous priming effects (e.g., Hartsuiker, Kolk & Huiskamp, 1999).

In Spanish in general, a postverbal subject (as in VS order) places focus on the subject NP because it is the sentence-final constituent (e.g., Zagana, 2002). If the priming observed occurred at the higher, conceptual level this could explain a persistence of the final word order without reference to a level of processing at which word order is independently specified. For example, when an unergative verb is used in SV word order, this is a default word order and therefore can be thought of not carrying focus on one particular constituent. In addition, because the verb is sentence-final there could be a focus on the verb. In contrast, VS word order results in a marked pragmatic focus on the subject of the unergative phrase. The unergative priming effect in Experiment 5 could therefore be explained as the persistence of the focus on a particular sentence constituent (e.g., a focused subject in a VS prime causing a VS target, and so placing focus on the subject).

However, the effect of focus on word order differs for unergative and unaccusative verbs (e.g., Hertel, 2003; Lozano, 2003, 2006). For unaccusatives, VS is a natural order in a neutral context, not carrying particular focus on either the verb or subject. According to theoretical arguments and experimental investigations (e.g., Hertel, 2003; Lozano, 2003, 2006), VS is the neutral context and SV is the structure carrying a

marked pragmatic focus (on the verb). Therefore, encountering an unaccusative prime using SV word order in Experiment 5 may have caused a conceptual persistence for focussing the verb, leading to it appearing in sentence-final position in the target.

If the observed priming effect is in fact due to priming of structure at the conceptual level, this makes predictions for when the prime verb and target verb come from different verb classes. The information structure of VS word order with an unergative verb places a strong focus on the subject, while the same word order with an unaccusative verb is neutral with respect to conceptual focus. Because the same word order with the different verbs results in different conceptual focus, no priming (or reduced priming) should be observed when the prime uses an unergative and the target an unaccusative.

Indeed, it could be that priming occurs at both levels – the conceptual level and the linear word order processing level. In this sense, priming would still be expected when prime and target verbs come from different classes, but a conceptual boost to priming would be seen when the prime and verb came from the same verb-class because this allows overlap in topic-comment structure.

8.4 Semantic boost to priming?

Assuming priming can be found across verb classes, predictions can be made about the relative strength of between- and within-class priming with respect to factors other than topic-comment structure and linear word order priming. Previous research has shown that overlap in the semantics of prime and target constituents enhances a syntactic persistence effect, both when the overlap is in the semantics of nouns in the structure (e.g., Cleland & Pickering, 2003) and when it is in the thematic roles the arguments represent (Chang, Bock & Goldberg, 2003; Griffin & Weinstein-Tull, 2003). With respect to the current study, utterances using unaccusative verbs will have more conceptual overlap with each other than with utterances using unergative verbs. All the unaccusative verbs used in this study refer to telic, nonagentive actions which denote a change of location (e.g., *arrive*, *leave*, *return*). In contrast, the unergative verbs refer to various atelic, agentive actions (e.g., *dance*, *run*, *swim*). There therefore is more overlap in semantics both in terms of thematic roles the verb selects for, and the action the verb denotes, between two

unaccusative verbs than between an unaccusative and an unergative verb. A semantic boost to priming might therefore be observed when prime and target are both unaccusative, compared to when the prime is unergative and the target unaccusative.

The finding of a boost to priming when the prime and target are both unaccusative could therefore be interpreted in several ways (a semantic boost due to the overlap in verbal semantics, or a boost to priming because of topic-comment structure overlap). I discuss this further in the discussion, but to anticipate the results no such boost was found.

8.5 Experiment 6

Experiment 6 employed the same technique as Experiment 5, and a subset of the pictures and descriptions, arranged in different prime-target pairings. All targets used unaccusative verbs, and these were paired with primes using either an unergative verb, or an unaccusative verb different to that in the target³⁷. The effect of interest was whether a VS priming effect would be seen with an unergative prime and unaccusative target and, if so, would it be of weaker or equal magnitude to priming when the prime and target both involved unaccusative verbs. In addition, I compared effects across L1 and L2 speakers of Spanish.

8.5.1 Participants

32 further participants were paid £5 to take part in the experiment. These were 16 L1 Spanish speakers and 16 intermediate-advanced L2 Spanish speakers for whom English was the first language (evaluated as in Experiments 1 and 2). Table 8-1 shows these participants' language background details.

³⁷ The same issues could be addressed using unergative targets instead. However, I chose unaccusative targets to maximise the likelihood of finding VS word order and a priming effect in the L1 speakers (in the different verb conditions in Experiment 5 the L1 speakers only produced 5% VS overall with the unergatives, but 10% with the unaccusatives. Priming was also 10% stronger with the unaccusatives than unergatives).

Language Group	Age	Sex ratio	Cloze score (out of 50)	Time in L2-country (months)
L1	24.5 (3.0)	8F / 8M	N/A	4.4 (3.1)
L2	21.5 (3.4)	10F / 6M	37.6 (7.9)	30.5 (18.4)

Table 8-1: Participant details for Experiment 6: (mean, with standard deviation in brackets).

8.5.2 Materials

The prime items consisted of 16 unergative and 16 unaccusative Matching pictures from Experiment 5, such that each of the 8 unergative verbs and 8 unaccusative verbs appeared on two pictures. The target items consisted of the 32 unaccusative Description pictures used in Experiment 5.

Each Description picture was paired with one unergative Matching picture and one unaccusative Matching picture (using a different verb to that on the target item). Two prime sentences were generated for each Matching picture, one using SV and one using VS word order, such that half the prime sentences corresponded to the picture and half used a different animal. Figure 8-1 shows an example of a Description picture, along with four prime sentences with which it was paired (i-iv). Each sentence represents a different prime condition, shown in brackets after each sentence.

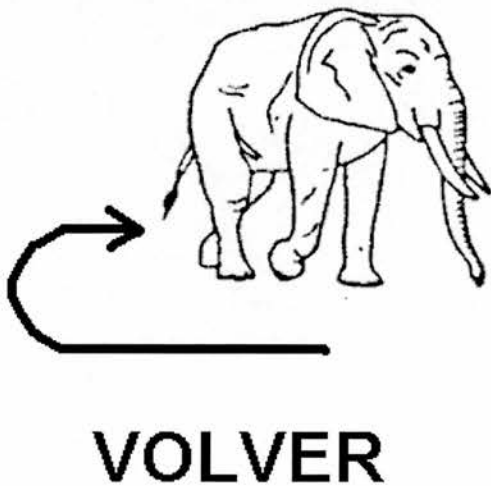


Figure 8-1

- (a) *La araña grita* ‘The spider shouts’ (unergative, SV construction)
- (b) *Grita la araña* ‘Shouts the spider’ (unergative, VS construction)
- (c) *El conejo viene* ‘The rabbit comes’ (unaccusative, SV construction)
- (d) *Viene el conejo* ‘Comes the rabbit’ (unaccusative, VS construction)

As in Experiment 5, these items were then placed into four lists, each comprising of eight items from each condition such that only one version of each Description picture-prime sentence pairing appeared in each list. The same filler pictures and sentences were used as in Experiment 5.

Individually randomized lists were prepared containing the 32 experimental items (32 sentences and corresponding Matching pictures, and 32 Description pictures to be described by the participant) and the 208 filler items (104 sentences and corresponding filler pictures and 104 fillers to be described by the participant) with the stipulation that at least two filler pairs intervened between any two experimental items.

8.5.3 Method and Scoring

As in Experiment 5 (see sections 7.3.3-7.3.4).

8.6 Results

A measure was computed of the relative proportions of VS target responses in each of the priming conditions (as in Experiment 5, this was the number of VS target responses divided by the sum of all SV and VS responses in that condition).

Scoring according to the used in Experiment 5 yielded a total of 1016 responses. This consisted in 880 SV responses (86.6%), 129 VS responses (12.7%) and 7 Other response (0.7%). The numbers of VS responses in each prime condition are listed in Table 8-2, and Figure 8-2 shows the same data in graphical format.

	SV / unerg	SV / unacc	VS / unerg.	VS / unacc.
L1	.02 (.02)	.05 (.04)	.13 (.07)	.14 (.07)
L2	.09 (.04)	.07 (.03)	.27 (.09)	.25 (.09)

Table 8-2: Number of VS targets produced in each prime condition, as a proportion of total responses (standard error values in brackets)

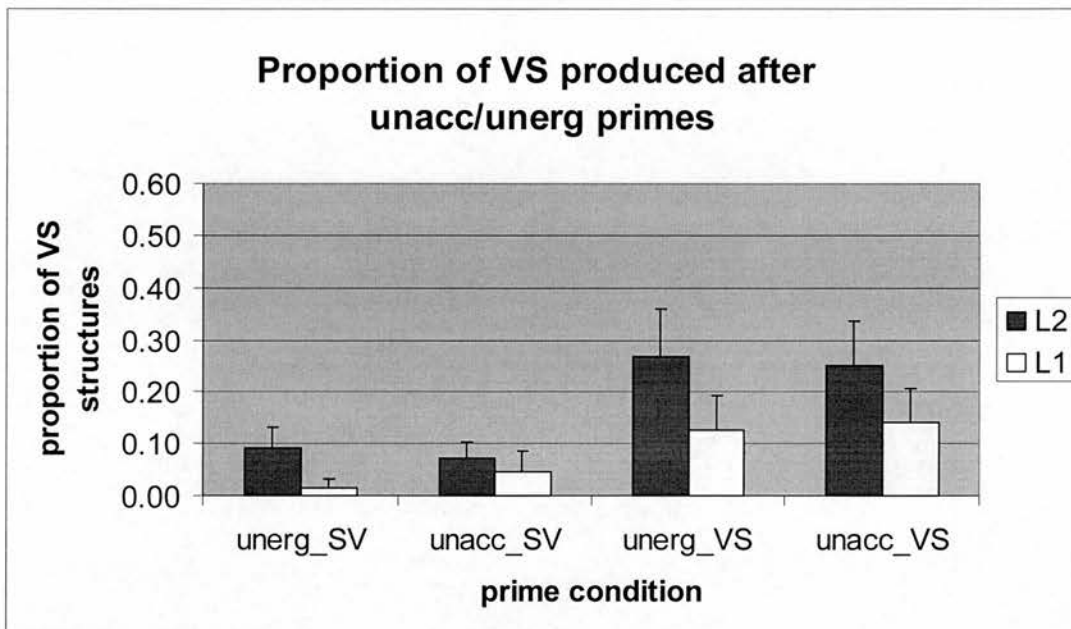


Figure 8-2: The proportion of VS targets produced in Experiment 6 by the two language groups (L1 and L2 Spanish speakers). The prime conditions were the following: unergative verb and SV word order in the prime (unerg_SV); unaccusative verb and SV word order in the prime (unacc_SV); unergative verb and VS word order in the prime (unerg_VS); unaccusative verb and VS word order in the prime (unacc_VS). Bars represent standard error values.

The data were analysed using a repeated-measures three-factor ANOVA, with the factors Native Language (L1 vs. L2), Prime (SV vs. VS), and Prime Class (Unergative vs. Unaccusative) (Native Language was a between-participants and within-items factor; Prime and Prime Class were within-participants and within-items factors). I conducted two ANOVAs, one with participants as a random factor ($F1$) and one with items as a random factor ($F2$). In this design, an effect of word order priming should be reflected as a significant effect of Prime, and an effect of the verb-class used in the prime should be

reflected as a significant effect of Prime Class and interaction of Prime and Prime Class. Table 8-3 shows the statistical outcomes of this analysis.

Only two effects were significant in this analysis. Firstly, there was a highly significant VS priming effect: 13.9% more VS targets were produced following a VS prime than an SV prime, as shown by a main effect of Prime. Figure 8-2 shows persistence of VS word order in both L1 and L2 Spanish speakers. Secondly, the L2 speakers produced 8.9% more VS structures overall than the L1 speakers, although this difference (main effect of Native Language) was significant by items only.

Source of variance	F1			F2		
	df	F1 value	MSe	df	F2 value	MSe
Prime	1,30	13.812**	.045	1,31	74.850***	.018
Prime x Prime Class	1,30	.043	.008	1,31	.026	.043
Prime Class	1,30	.014	.011	1,31	.029	.043
Native Language	1,30	1.503	.168	1,31	20.556***	.022
Prime x Native Language	1,30	.998	.045	1,31	2.117	.040
Prime Class x Native Language	1,30	1.309	.011	1,31	1.290	.023
Prime x Prime Class x Native Language	1,30	.082	.008	1,31	.332	.022

Table 8-3: Statistical results of 3-way ANOVAs with Native Language, Prime and Verb-Class as factors.

No other results approached significance. Of specific interest, there was no interaction between Prime and Prime Class, indicating that priming of a target involving an unaccusative verb was equally as strong when the prime used an unergative verb as when it used an unaccusative verb. I also performed paired planned comparisons across each level of Prime Class. This confirmed that there was significant priming both when the prime was unergative ($t1(31)=3.19, p<.01; t2(31)=5.16, p<.001$) and when it was unaccusative ($t1(31)=3.77, p<.01; t2(31)=4.31, p<.001$).

To ensure that these effects held for both L1 and L2 speakers, I then performed separate 2-way ANOVAs over each level of Native Language, with Prime and Prime Class as within-participant and within-item factors.

8.6.1 L1 speakers

Table 8-4 shows the statistical outcomes of the analysis on the L1 data. As can be seen, there was a clear effect of Prime: more VS were produced after a VS than an SV prime. However, the class of the verb used in the prime affected neither the overall proportion of VS produced (no main effect of Prime Class) nor the magnitude of priming (no interaction of Prime and Prime Class).

In addition, planned comparisons over each level of Prime Class confirmed that there was significant priming when the prime was unaccusative ($t(15)=2.35$, $p<.05$; $t(31)=2.46$, $p<.05$), and when it was unergative (marginal in the participants analysis and significant in the items analysis ; $t(15)=2.00$, $p=.06$; $t(31)=3.30$, $p<.01$).

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Prime	1,15	5.993*	.028	1,31	24.747***	.015
Prime x Prime Class	1,15	.135	.007	1,31	.232	.030
Prime Class	1,15	1.134	.008	1,31	.615	.035

Table 8-4: Statistical results of 2-way ANOVAs on L1 data, with Prime and Verb-Class as factors.

8.6.2 L2 speakers

Table 8-5 shows the statistical outcomes of the analysis on the L2 data. The results are identical to those for the L1 speakers. As can be seen, there was a clear effect of Prime: more VS were produced after a VS than an SV prime. However, the class of the verb used in the prime affected neither the overall proportion of VS produced (no main effect of Prime Class) or the magnitude of priming (no interaction of Prime and Prime Class).

In addition, planned comparisons over each level of Prime Class confirmed that there was significant priming both when the prime was unergative ($t(15)=2.46$, $p<.05$; $t(31)=3.71$, $p<.01$) and when it was unaccusative ($t(15)=2.90$, $p<.05$; $t(31)=3.69$, $p<.01$).

Source of variance	F1			F2		
	<i>df</i>	F1 value	MSe	<i>df</i>	F2 value	MSe
Prime	1,15	8.034*	.062	1,31	24.784***	.042
Prime x Prime Class	1,15	.003	.009	1,31	.039	.034
Prime Class	1,15	.406	.014	1,31	.291	.031

Table 8-5: Statistical results of 2-way ANOVAs on L2 data, with Prime and Verb-Class as factors.

8.7 Discussion

Experiment 6 produced three results of interest. First, sentences using unergative verbs were able to prime the word order of sentences using unaccusative verbs. Second, there was no difference in the magnitude of priming seen when the prime verb was from the same class as the target (unaccusative) compared to when it was from a different class (unergative). Third, the L1 and L2 speakers behaved similarly in these respects. The only difference found across the L1 and L2 speakers was that L2 speakers produced more VS structures overall. Importantly, equal priming was found regardless of language background, so the discussion which follows about processing of word order in Spanish should be equally applicable to L1 and L2 speakers.

Before discussing the implications of the current findings in more detail, I note that the magnitude of priming found in Experiment 6 when the prime and target were both unaccusative was approximately 10% less than in the same condition in Experiment 5 (unaccusative prime and target, different verb): e.g., the L1 speakers showed 19% priming in Experiment 5 and only 9% in Experiment 6, while the same figures for the L2 speakers were 30% vs. 18%. A plausible explanation is that the presence of the same-verb condition boosted overall production of VS structures in Experiment 5. Previous priming studies have found long-term effects of priming on the likelihood of using a particular structure in general. For example, in Hartsuiker and Westenberg's study on word order priming in subordinate clauses in Dutch (2000), they measured a pre- and post-experimental baseline (see also Hartsuiker & Kolk, 1998a, and Hartsuiker, Kolk & Huiskamp, 1999). The Dutch results showed a significant increase in the proportion of the lower-frequency structure (auxiliary-final order) over the course of the experiment. Hartsuiker and colleagues proposed that repeated exposure to the less frequent structure

in experimental trials leads to increased resting-level of the representation of that structure, making it more likely to be used in general. In the current study, VS may be considered the less frequent option (in the unaccusative-prime condition of Experiment 6 overall responses consisted in 12.7% VS compared to 86.6% SV; in the unaccusative condition in Experiment 5 these figures were 33.4% vs. 66.6%). In Experiment 5, the presence of the same-verb condition may have led to more VS structures being produced overall during the experiment. This would, in turn, lead to an increased likelihood of producing VS even in the different-verb condition. Because Experiment 6 used only different-verb conditions, fewer VS structures were produced overall and so there is a smaller tendency to repeat a VS prime.

In the next sections I interpret the current findings in the light of linguistic theories about split intransitivity, and models of syntactic priming in language production, as well as discussing the implications for L1 vs. L2 models.

8.7.1 Locus of priming: linear word order, underlying syntactic operations, or conceptual structure?

The results of Experiment 5 showed structural priming of VS word order: more VS word order produced after VS primes, when the verbs used in the prime and target were always from the same lexical class (i.e., both unaccusative or both unergative). This persistence could be attributed to a stage in language production where linear word order is computed, e.g., during positional processing (e.g., Hartsuiker & Westenberg, 2000). In the introduction to this chapter I considered alternative explanations for this persistence, both of which can be ruled out on the basis of the results of Experiment 6.

The first explanation was based on the proposal by theoretical linguists that unaccusative and unergatives differ syntactically: structures involved in the two verb-types are underlain by different syntactic structures even when the derived word order appears the same. Therefore, it could be these underlying structures, or syntactic operations mapping base-generated to derived structures, that are primed and not linear word order. This made the prediction that priming should not be observed when the prime and target used intransitive verbs from different classes. However, Experiment 6 shows clear VS priming from unergative prime sentences to unaccusative targets, which

would not be possible if the primed structure were different for each. The results therefore suggest that what is persisting, and hence the locus of the priming effect, is linear word order, and not movement processes which would differ across the verb classes. Furthermore, I found no evidence that ‘movement’ occurs in real-time cognitive processing: my results do not support that language production involves a stage during which grammatical roles are assigned and then undergo changes, e.g., the underlying object of an unaccusative becoming a surface subject to create SV word order. I found no differences in the way word order is processed for unergative or unaccusative verbs in terms of the impact this processing had on subsequent production: priming was of equal magnitude regardless of the class of verb used in the prime. In the absence of positive evidence for transformations or movement, I therefore concur with Bock and Levelt (1994) that including these syntactic operations in a model of language production adds unnecessary complexity. However, this issue requires further investigation because, as discussed in Chapter 2, recent cross-modal priming studies demonstrate that the argument of an unaccusative verb in SV order is reactivated post-verbally, and argue this implies some form of movement from object to subject position, leaving a trace (e.g., Montrul, 2004).

A second alternative explanation for the priming effect could be that VS priming is due to persistence at a conceptual level, such that the different word orders bring with them different topic-comment structures, and it is these conceptually focussed structures which are primed (Hartsuiker & Kolk, 1998a; Hartsuiker, Kolk & Huiskamp, 1999). However, in the introduction to this chapter I discussed how the same word order creates different conceptual focus depending on the class of verb involved. While VS is a context-neutral word order with an unaccusative verb, VS with an unergative verb creates a strong focus on the subject of the phrase. An explanation of priming at the conceptual level would therefore predict a stronger unaccusative-to-unaccusative priming effect compared to an unergative-to-unaccusative condition, because in the former condition the topic-comment would be repeated across prime and target. However, the fact that both verb types prime unaccusative targets to the same extent serves as further evidence that what is being primed is linear word order and not topic-comment structure.

8.7.2 Lack of priming boost from semantic overlap of the verb

The finding of equal priming regardless of the semantics of the prime verb has implications for syntactic priming models. In Chapter 2 I discussed how previous studies have found semantic overlap across a prime and target can boost the magnitude of priming observed. Stronger priming was therefore anticipated from unaccusative to unaccusative verbs, where there is strong overlap in the thematic role of the argument and the semantics of the verb, than from unergatives to unaccusatives, where there is little conceptual overlap. However, no such effect emerged. This may be explained by crucial differences between the current study and previous priming studies which found a semantic boost. Cleland and Pickering (2003) both looked at the semantic overlap of noun phrases within prime and target. The noun phrase arguments in my study were very similar for the unergative and unaccusative prime conditions (depicting animals), so the key difference was in the verbal semantics. There may be specific differences in how noun and verb semantics are represented (e.g., nouns having richer semantic networks?) which result in different semantic effects on priming.

Chang, Bock and Goldberg (2003) and Griffin and Weinstein-Tull (2003) studied the effects of overlap in thematic roles on priming, which may seem more relevant to the current study. However, Griffin and Weinstein-Tull found stronger priming when the *number* of conceptual roles was the same in prime and target than when it was different. Chang et al. demonstrated priming of the order of thematic roles independent of syntactic structure, using verbs which selected for two object constituents. Both studies examined the effect of thematic roles on the order of NP constituents relative to each other. In contrast, the current experiment used phrases involving only one thematic role, corresponding to one NP constituent, and the priming effect observed was on the relative order of verb and NP. This makes the current study different to previous findings of semantic effects on structural priming. However, Experiment 6 was not designed to examine this issue directly, so given that I did not find any priming differences I will not discuss the issue further.

8.7.3 The locus of preference/frequency effects in priming

In relation to the lack of difference in priming magnitude across unergative and unaccusative primes, I return briefly to the discussion at the end of the last chapter about the locus of the unergative-unaccusative difference in priming and whether it is in the properties of the prime or the target structure. This research casts some light on the extent to which priming effects are influenced by characteristics of the prime versus the target utterance.

Experiment 5 found the preferences that intransitive verbs have for a particular word order influences both the proportion of VS produced overall and, in L1 speakers, the strength of a priming effect. Thus, the word order preference of these verbs influences priming, but because the primes and targets in Experiment 5 came from the same verb-class, it is difficult to conclude whether this effect of priming was due to the preferences of the prime verb, the target verb, or some combination of the two.

Experiment 5 produced some evidence for the preference of the verb in the *target* utterance determining priming magnitude: there was a correlation between magnitude of priming and the preference of native speakers for the verb involved in the target. However, there could also have been an effect of the preferences of the verb used in the *prime*, not detected in this analysis.

Experiment 6 provides more evidence to support that it is the preference of the target which determines word order effects in production. Firstly, the amount of VS structure produced overall in the current study was the same regardless of the verb used in the prime (12.8% VS after an unaccusative prime vs. 12.5% VS after an unergative prime). This points to the key determinant of word order preferences in production being the verb currently used (the target), and not the verb used in any previously processed sentences. Secondly, the same unaccusative targets were paired with both unergative and unaccusative primes. If there were an effect of the preference of the verb in the prime on priming magnitude we should have seen stronger priming with unaccusative than unergative primes. However, no such difference was found, again pointing to the preferences of the target being the crucial determinants of production patterns.

In approaches such as that proposed by V.S. Ferreira (2003b), characteristics of the prime are held to be of primary importance. He assumes an implicit learning account

of priming in which the less expected the outcome, the stronger the effect on learning. Dispreferred structures are less expected outcomes, so primes using a dispreferred structure exert a stronger effect on the language system and give rise to greater priming. This is in contrast to the current findings. In addition, this theory will need to be extended to account for the general finding in this thesis that strongly dispreferred structure show only limited priming. It is not clear how verb class preferences might correspond to or interact with the general structural preferences considered by Ferreira, but this represents an interesting avenue for future research.

8.7.4 Comparison of L1 and L2 Spanish

I finish this chapter by returning to the main focus of this thesis: a comparison of sentence production in L1 and L2 speakers of Spanish. Experiment 5 demonstrated similar VS priming in both L1 and L2 speakers, as well as a lexical boost to this priming. In contrast, the L2 speakers showed stronger priming and stronger lexical boost than L1 speakers when prime and target used unergative verbs. This can be explained as L2 speakers not having acquired the lexical constraints on using VS with unergative verbs, which L1 speakers of Spanish find infelicitous. Hence, L2 speakers produce VS order in contexts where L1 speakers of Spanish would not consider VS order a viable option to express a message.

In Experiment 5 when the prime and target were unaccusative, priming effects were comparable regardless of language background; in Experiment 6, likewise there was comparable priming between L1 and L2 priming when the target verbs were unaccusative, regardless of prime type. This further supports that locus of any verb-dependent effects on priming magnitude is in the target and not the prime, because L1 and L2 priming was the same even when an unergative verb was used in the prime.

However, even if an effect of target had been found in the L1 speakers, it might not have been expected in the L2 speakers, given that they showed no unergative-unaccusative priming differences in Experiment 5.

The only difference between the two groups was that the L2 speakers were more likely to use VS structure overall (although there was no baseline condition to assess usages in the absence of priming). This fits with other findings that more advanced L2

speakers tend to use VS more than L1 speakers of Spanish. For example, Hertel (2003) found that even with unaccusative verbs, advanced L2 speakers used 53.6% VS compared to 36.4% by L1 speakers, although it is not clear why this should be the case.

Importantly, the finding of very similar effects across the two language groups in Experiment 6 supports that the factor being primed is linear word order in both L1 and L2 speakers, and not another factor such as underlying syntactic structure or topic-comment structure. This adds further weight to the argument that L1 models of word order processing (at the positional level of production) can be applied to L2 speakers.

8.8 Summary

Experiment 6 served to address several important issues about processing of word order and lexically-dependent word order preferences in speakers of Spanish. I presented a priming study that produced equally strong word order priming when the prime and target used verbs from the same lexical class (both unaccusatives) and when they were from different classes (unergative prime verb, unaccusative target verb). This was the case for both L1 and L2 speakers of Spanish. I interpreted these results as evidence that the priming effect in Experiments 5 and 6 is one of linear word order, and not of theoretical underlying syntactic structures which differ across the verb groups, or of topic-comment structure. I found no evidence for the psychological reality of movement in producing difference surface-level word orders with unergatives and unaccusatives. In addition, there was no boost to priming from semantic overlap in the prime and target verb, although semantic priming effects have been previously found when the overlap is in noun phrases or thematic roles. Finally, the results suggest that the effect of stronger priming with unaccusative than unergative verbs in Experiment 5 was due to structural preferences of the target verb and not the prime.

9 Conclusions

This chapter forms the conclusion of the thesis and is divided into two sections. Firstly, I summarise the main findings of this thesis, along with the implications of my findings. Secondly, I discuss some unanswered questions and directions for future research in this area.

9.1 Summary and conclusions

The main aims of this thesis were to investigate syntactic production in L2 speakers using methods and to compare the results to those from L1 speakers in order to examine the extent to which models of L1 processing can be extended to L2 processing. Models of L1 production assume that there must be syntactic processes that are concerned with specifying hierarchical structure and linear word order of constituents. This research addressed these different aspects of processing through a series of experimental investigations that examined structures which differed in different aspects: Experiments 1-3 dealt with processing of hierarchical structures in production, while Experiments 4-6 dealt with word order processing and the effect of lexical semantics upon this.

The results of the experiments showed broad similarities in the ways in which L1 and L2 speakers appear to represent and process syntactic structures. This suggests that psycholinguistic models of L1 sentence production can also be extended to L2 speakers. However, there were also some important differences in L1 and L2 behaviour. Specifically, L2 speakers showed less sensitivity to constraints on the appropriateness of particular syntactic options, and showed increased susceptibility to priming of structures that L1 speakers dispreferred. This fits well with previous linguistic findings on L2 optionality and incomplete acquisition of interface constraints on syntax.

I will now discuss the findings and implications of each experiment in turn.

9.1.1 Experiments 1-2: Priming of actives and passives in Spanish

Experiment 1 used a dialogue picture-matching and -description task to look for priming in L1 Spanish speakers and intermediate-advanced L2 speakers of Spanish (English L1). Primes used either the same or a different verb as the target, and either an active or passive structure. Experiment 2 used the same materials and participant-pool as Experiment 1 but used a computerised task, in order to control for social pressures to conform to the speech of a native speaker interlocutor. Both English and Spanish allow active and passive forms, which are similar in surface structure, but the passive in Spanish is a dispreferred option.

The results produced significant priming effects: L1 and L2 participants at both proficiencies were more likely to produce a passive following a passive prime than following an active prime. This represents a novel finding of priming in L2 speakers when both prime and target are in the L2. The results in Experiments 1 and 2 were very similar, despite differences in modality of input and social context, supporting the robustness of the L2 priming effects. In addition, mirroring previous findings, priming was enhanced by the repetition of the verb across prime and target in both L1 and L2 speakers.

Because L2 priming was found in the absence of lexical overlap across prime and target, this supports that even lower-proficiency L2 speakers possess an abstract representation of the passive, which is shared across different verbs. Furthermore, the lexical boost to priming suggests that the L2 architecture, as has been proposed for L1 speakers, contains primable links between individual lexical items and syntactic representations. Interestingly, the L1 speakers did *not* show significant priming in the absence of lexical overlap, suggesting some resistance to priming of the passive in native Spanish speakers. In addition, the L2 speakers produced more passives overall across all conditions than the L1 speakers.

In terms of developmental effects, neither priming magnitude nor lexical boost varied with L2 proficiency, suggesting that abstract syntactic structures are in place early on in the L2 acquisition process and do not change significantly with more exposure. In addition, this suggests that the way these structures are processed does not change with

exposure. However, the L2 speakers at all proficiencies showed stronger priming than the L1 speakers.

9.1.2 Experiment 3: Priming of PO and DO datives in English

Experiment 3 used a computerised priming task in English to address why stronger priming was found in L2 speakers, as well as exploring what role structures in the L2 speakers' L1 play in L2 processing. Participants were English-L1 speakers and two advanced English-L2 groups (Spanish-L1 and German-L1), and primes used either DO or PO dative structures, or an intransitive structure as a neutral baseline. These native speaker groups were chosen because German, like English, allows both PO and DO structures, while Spanish only allows the PO.

Results showed bidirectional priming of both dative structures in all language groups relative to the baseline, extending the finding of L2 syntactic priming to different structures and language groups. This also demonstrated L2 priming for a structure not available in a learner's L1, because the Spanish-L1 group showed significant DO priming in English despite this not being an option in Spanish. L2 speakers can therefore acquire new structures which cannot simply be transferred from their L1, and these structures are then processed in similar ways to in native speakers of the target language.

Interestingly, there was no reliable difference in priming magnitude across the L1 and both L2 groups, nor were there significant differences in the groups' baseline preferences for each structure. The key difference between this experiment and the previous two was the structural preferences of the native speaker group. Taken together, Experiments 1 to 3 suggest that L2 speakers are more susceptible to priming than natives when the primed structure is infelicitous for the native group. In contrast, when the primed structures are both acceptable for L1 speakers in the experimental context, similar priming magnitudes are found in L1 and L2 speakers.

These findings are consistent with previous findings that L2 speakers appear to over-use structures which L1 speakers disprefer or find inappropriate in a particular context (cf. Sorace, 2005): L2 speakers, even at an advanced stage of proficiency, often show incomplete acquisition of the constraints governing when particular structures can be used. I argue that this results in a higher susceptibility to priming from the syntactic

context in L2 speakers, whereas native speakers resist priming of structures in contexts where those structures would be inappropriate (cf. Hartsuiker & Kolk, 1998a; Pickering, Branigan & McClean, 2002)

Finally, the results suggest that structures available in a learners' L1 have little effect on syntactic processing in the L2, because no reliable differences were found for L2 speakers from Spanish-L1 and German-L1, despite differences in the structures available in these L1 languages.

9.1.3 Experiments 4-5: Word order preferences in L1 and L2 Spanish

Experiments 4 and 5 focused on processing of word order, in order to assess how similar processing of word order is across L1 and L2 speakers. In addition, these experiments examined how lexical factors influence word order processing. Lexical semantics have previously been shown to influence grammatical role assignment preferences (F. Ferreira, 1994). However, little is known about the way in which lexical factors can influence real-time production of word order. Experiment 4 used an off-line questionnaire to assess whether the choice of verb influenced word order preferences in L1 Spanish speakers and intermediate-advanced L2 Spanish speakers with English-L1. The questionnaire used two types of intransitive verbs: unergatives, which denote an agentive and atelic action, like *shout*, and unaccusatives, which denote a non-agentive and telic event, like *arrive*.

Results confirmed previous linguistic findings that L1 Spanish speakers prefer subject-verb (SV) word order with unergative verbs, and verb-subject (VS) order with unaccusative verbs. In contrast, the L2 speakers showed more variable word order preferences, which did not map straightforwardly onto the two verb-class types, suggesting they have not acquired native-like preferences for word order.

Experiment 5 explored these preferences in sentence production, using a computerised syntactic priming task. Participants were L1 Spanish and English L1-Spanish L2 speakers, and primes used either the same or different verb as the target, with either SV or VS word order. In addition, the experimental items for half the participants used unergative verbs and the experimental items for the other half used unaccusative verbs.

Results provided the first demonstration of priming using this word order alternation: both L1 and L2 speakers were more likely to produce VS word order following a VS prime than following an SV prime. This suggests that L2 speakers possess abstract knowledge about word order options in the new language, as suggested above for phrasal structure knowledge, and that the processing of linear word order is similar in L1 and L2 speakers.

In addition, the priming effect in both L1 and L2 speakers was boosted by lexical overlap across prime and target. This lexical boost has not previously been demonstrated for word order, even in L1 speakers, and suggests the existence of associations between specific lexical items and word order representations which can themselves be primed. This has implications for models of language production, which must incorporate a way for lexical semantic factors to influence choice of word order in positional processing.

Interestingly, there was also an influence of verb class preferences for word order on the priming effects observed, which has not previously been demonstrated in priming studies. L1 Spanish speakers showed significantly stronger VS priming and a stronger lexical boost when the verb involved was unaccusative than when it was unergative. This can be explained in the same way as the resistance in L1 Spanish speakers for priming of the dispreferred passive: in a neutral context, native speakers find VS order highly acceptable with unaccusative verbs, but pragmatically anomalous with unergative verbs. It appears that use of an infelicitous structure is resisted by native speakers, even with the boost conferred by priming. Indeed, similar to the finding of passive priming in L1 speakers, in the case of unergatives significant VS priming was only found when the prime and target used the same verb and not different verbs. The magnitude of a lexical boost is also affected by lexical dispreferences, possibly reflecting that the link between unergative verbs and VS word order is more resistant to priming than that between unaccusatives and VS.

In contrast, the L2 speakers showed no difference in the magnitude of priming or lexical boost across unergative and unaccusative verbs. They did produce more VS structures overall with the unaccusative than unergative verbs, reflecting a sensitivity to how the verb classes mapped onto word order preferences. However, in terms of processing, L2 speakers did not show the same resistance to priming of VS with

unergative verbs as native speakers. This suggests that the L2 architecture has not acquired native-like constraints on felicitousness of word order as dependent on lexical semantic factors.

In support of this, when the verbs were unaccusative, the L1 and L2 speakers showed equal priming and lexical boost effects, and L1-L2 differences in magnitude of priming only emerged with the unergative verbs.

9.1.4 Experiment 6: Cross-class priming of intransitive verbs

Experiment 6 explored the findings of Experiment 5 further by looking at word order priming when the prime and target verbs came from different intransitive classes. The task and population sampled were as in Experiment 5. All targets used unaccusative verbs, and half the primes used unergative verbs while the other half used unaccusatives (there was no repeated-verb condition in this experiment).

Proponents of a syntactic theory of the unergative-unaccusative distinction claim that the two verb-types have different syntactic structures. The argument of unergative verbs is base-generated in preverbal subject position, and movement is required to create VS order. In contrast, the argument of unaccusative verbs is base-generated in postverbal object position, and movement is required to map onto SV order. If the observed priming in Experiment 5 reflected persistence of these underlying syntactic structures, no cross-verb priming would be expected. The results showed significant priming in both L1 and L2 Spanish speakers regardless of whether the prime and verb came from different classes or not. Indeed, priming was of equal magnitude regardless of prime verb class. This supports an explanation of this priming as the persistence of representations of linear word order that are shared between all intransitive verbs tested. In addition, this suggests that the effects of verb class on L1 priming in Experiment 5 stem from preferences in processing the target and not the prime, because varying the prime verb did not affect priming magnitude.

The results of this study also suggest there is no boost to priming conferred by semantic overlap of the prime and target involved: the magnitude of priming was equal when the prime used unergative verbs as when it used unaccusatives, despite unaccusative verbs being more semantically similar to each other than to unergative

verbs. This additionally implies that magnitude of priming is determined by the lexical preferences of the verb in the target and not the prime, because otherwise stronger priming might have been expected with unaccusative than unergative primes in the L1 speakers.

9.1.5 Summary and implications of findings

The findings in this thesis provide experimental evidence that L2 production involves similar processing mechanisms and architecture for assembling syntactic structures in production as in L1 speakers of the same language. L2 speakers appear to possess abstract representations for structural options in the target language, even when an option does not exist in their L1. This was found for structures which differ both in terms of functional factors (hierarchical phrasal structure) and positional factors (linear word order structures).

Key differences emerged in the L1 and L2 production systems in cases where native speakers found a particular syntactic structure inappropriate. L1 speakers resisted priming of structures they found infelicitous, either in the particular context (as with the passive in Spanish) or with particular lexical items (as with VS word order used with unergative verbs). In contrast, non-natives appear to not have fully acquired these constraints on syntactic structure usage, which is reflected by the L2 groups showing increased susceptibility to priming of these inappropriate structures. This fits well with off-line findings of L2 optionality, that L2 speakers have persistent difficulty in acquiring constraints on the use of syntactic options in the new language.

Overall, the findings support that psycholinguistic models of L1 sentence production (e.g., Bock & Levelt, 1994; Kempen & Hoenkamp, 1987; Levelt, 1989) can be applied to L2 speakers, because broadly similar architecture and processing mechanisms are implicated in L1 and L2 syntactic production. Previous attempts to model production have adapted well-established L1 models for the L2 speaker but in a descriptive and speculative way, because of a lack of empirical evidence for L2 processing at the sentence level (e.g., de Bot, 1992; de Bot & Schreuder, 1993; Pienemann, 1998; Truscott & Sharwood Smith, 2004). For example, the current evidence that syntactic production is similar in L1 and L2 speakers is consistent with Truscott and

Sharwood Smith's (2004) assumption that the same processing system is involved in the acquisition and processing of L1 and L2 syntactic structures.

In addition, this thesis contributes to the expanding work comparing L1 and L2 processing using psycholinguistic methods (e.g., Clahsen & Felser, 2006; Dussias, 2003; Felser, Roberts, Gross & Marinis, 2003; Nicol & Greth, 2003; Papadopoulou & Clahsen, 2003). The majority of these studies have addressed L2 processing in *comprehension* and have found that L2 speakers often do not apply native-like syntactic strategies in processing the target language. For example, Clahsen and Felser proposed in their (2006) review paper that while L2 speakers are sensitive to lexico-semantic cues in parsing syntactic structures, they compute shallower and less detailed syntactic representations during language comprehension than native adult speakers. I also found key differences in the way in which L1 and L2 speakers produced particular structures in the target language - but these contrast with the findings in comprehension. For example, in Experiment 5 although syntactic processing in general was similar across the L1 and L2 speakers, the L2 speakers in Experiment 5 were not sensitive to lexical constraints on syntactic processing in production. Below I discuss in more detail how a model of language production can be adapted to account for these findings.

On a related note, the current thesis demonstrates a further way in which techniques from experimental psychology can be used to directly compare L1 and L2 syntactic processing. This provides a method for evaluating whether L1-L2 differences lie in processing or in impaired knowledge (as can be assessed in off-line studies). The distinction between syntactic representation and processing is often made in the second language literature, but largely on the basis of off-line findings which cannot distinguish between the two (e.g., Beck, 1998; Lardiere, 1998; Prévost and White, 2000).

I conclude this section by discussing specific models of L1 and bilingual production based on syntactic priming in production. The current results can therefore be directly compared to these models and adaptations can be suggested in order to account for the current findings (Hartsuiker et al, 2004; Pickering & Branigan, 1998). Figure 9-1 shows Hartsuiker et al.'s model of the bilingual architecture, which incorporates that analogous syntactic structures are shared across languages, as for the Active and Passive

in English and Spanish. The original model would need to be adapted in several important ways in order to be able to account for the current data.

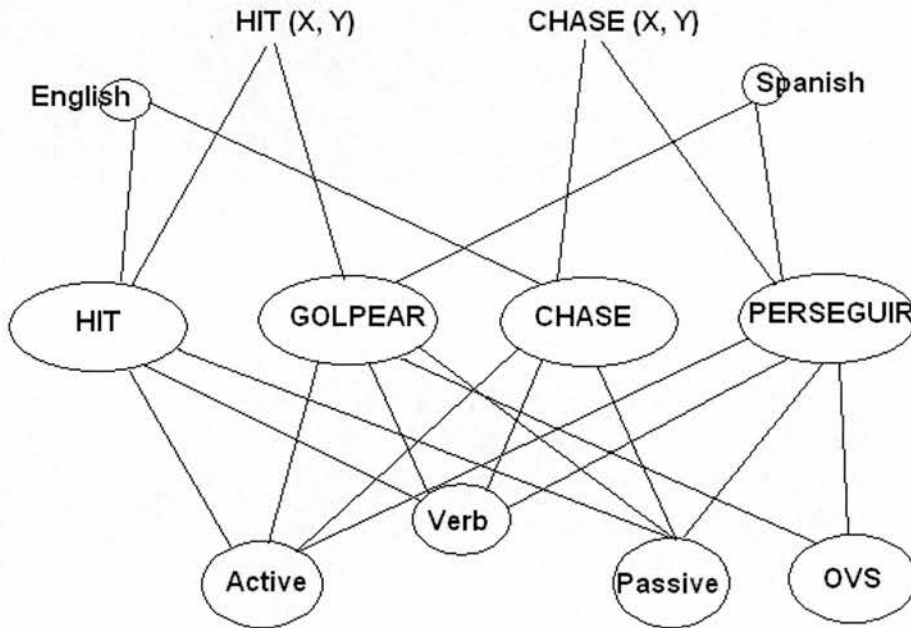


Figure 9-1: An adaptation of Hartsuiker, Pickering and Veltkamp's model of the bilingual architecture (2004). The example shows lexical entries for *to chase* and *to hit* in an integrated (shared lexicon, shared syntax) account of bilingual language representation. Each lemma node (e.g., HIT, GOLPEAR) is connected to a concept node (HIT(X,Y) or CHASE (X,Y)), a category node (Verb), combinatorial nodes (Active, Passive and OVS), and a language node (English and Spanish).

Firstly, when a structure exists in the L2 without an analogous structure in the L1, there must be a mechanism by which new syntactic representations can be formed when sharing a pre-existing representation in the L1 is not possible. For example, the L1 Spanish-L2 English speakers tested in Experiment 3 showed similar priming of the English DO structure as native speakers, despite this structure not existing in their L1. By analogy, Figure 9-1 includes a node representing the OVS structure. Because this structure does not exist for English speakers in their first language, they must develop a new syntactic representation for the OVS when learning Spanish. As such, this node is linked only to lemmas of Spanish words and not English words, to represent that OVS can only be used with Spanish verbs.

Secondly, even if a structure is shared across languages, it may behave differently in the two languages. None of my experiments directly compared processing of a particular structure in a particular speaker's L1 and L2. However, a comparison can be made between production of the passive by the L1 Spanish speakers in my Experiment 1 and the L1 Spanish-L2 English speakers in Hartsuiker et al.'s study (2004). Hartsuiker et al. (2004) found that their participants when speaking in their L2 English produced 35% passives overall (44% passives as a proportion of the total passives and actives), and showed a 19% passive priming effect following a passive prime compared to an active. This contrasts with my finding that Spanish L1 speakers produced 10% passives across Experiment 1, and showed no passive priming in the absence of lexical overlap (although their experiment used cross-linguistic priming and not purely Spanish to Spanish priming). This suggests that L1 Spanish speakers may process the passive differently in L1 Spanish and L2 English. Thus, if syntactic structures are shared across lemmas from different languages, language-specific preferences must also be represented. This could be done by varying the strength of connections between combinatorial nodes and lemmas from each language. Alternatively, there may be some link between the language nodes and specific combinatorial nodes which could reflect preferences across a language.

Thirdly, the model (and similar L1 models, e.g., Pickering & Branigan, 1998) must be extended to incorporate the finding that word order selection is influenced by lexical factors. Experiment 5 demonstrated a lexical boost to word order priming in both L1 and L2 speakers, which implies the existence of similar associations between lemmas and linear word order options as with combinatorial nodes in the current models. Pickering et al. (2002) proposed an extension of Pickering and Branigan's model in which combinatorial nodes are specified for orders of phrases, and as such can represent both word order and hierarchical aspect of a syntactic structure. This model can account for the current results if SV and VS word order are represented as two different combinatorial node options connected to intransitive verbs. Each specifies that the verb can be combined with a subject NP, but in different orders. In this way, the lexical boost to word order can also be explained as the priming of links between combinatorial nodes and lemma items.

Fourthly, the model must be able to account for the finding in Experiment 5 that the strength of priming and lexical boost can vary depending on the lemma involved. The results of Experiment 6 suggest the source of these differences lies in the association between a target lemma and the persisting structure. The most obvious source of this finding would be in the strength of links between individual lemmas and combinatorial nodes. Indeed, connectionist model approaches to processing would predict that stronger links would lead to stronger priming (e.g., Rumelhart & McClelland, 1998). However, research is needed to confirm that lexical preferences can also influence the strength of priming of phrasal combinatorial options (e.g., PO vs. DO).

9.2 Directions for future research

I finish this chapter by proposing some directions for future research on this topic, based on the issues raised during the course of the thesis. These fall into four broad areas. Firstly, testing other types of L1-L2 pairings to extend the current findings. Secondly, comparing L2 production in adults with L1 production in children, as has been done in the field of comprehension processing. Thirdly, using on-line techniques to look at different types of L2 optionality, specifically comparing how pragmatic-discourse factors influence structural preferences in L1 and L2 speakers. Fourthly, exploring the novel finding of lexico-semantics effects on syntactic priming, to further understand the locus and nature of these effects in production.

9.2.1 Priming in different groups – different L1s and L2s, extremes of proficiency, balanced bilinguals

The ultimate aim of psycholinguistic research is to establish how the brain deals with language processing, and thus studies of L2 production would aim to be able to account for any individual speaking an L2. However, in order to draw firm conclusions on L2 processing, a range of different L1 and L2 pairings should be examined. The experiments described here only looked at limited L1-L2 pairings (English L1 and L2, Spanish L1 and L2, and German L1). It would be beneficial to replicate the current findings across different L1 and L2 groups to confirm they are not a result of characteristics of the languages studied. Only in this way can we draw firm conclusions about L2 processing in general, and how similar it is to L1 processing.

For example, do word order preferences in the L1 affect processing in the L2? This could be studied through Japanese-L1 learners of Spanish. Japanese is a head-final language which requires the verb to appear in final position, so VS word order constitutes a violation of a hard grammatical constraint. This contrasts with English, which does occasionally allow VS order, given a suitable context (e.g., *there*-construction, or a preverbal locative). It would therefore be interesting to explore whether Japanese learners of Spanish behave in the same way as the English-L1 group in Chapters 6-8 in terms of the occurrence and magnitude of word order priming.

Likewise, I argued that the over-use of inappropriate constructions by L2 speakers reflects incomplete acquisition of constraints on structural felicity. This may be a property of language learners in general, caused by processing limitations on integration of relevant information (e.g., Sorace, 2005). This account predicts that L2 learners from all backgrounds would show similar effects. Alternatively, the L2 insensitivity to lexical or discourse constraints on syntactic processing may depend on whether a constraint exists in the learner's L1 or not. If L2 speakers possess an L1 with similar structural constraints as the target language, they may be able to transfer knowledge of these constraints across languages. For example, Italian learners of Spanish, in whose L1 the passive is also very marked, may pattern with the Spanish native speakers and not with the English learners of Spanish. However, there is some evidence to support a theory of L2 speakers in general showing insensitivity to discourse constraints on syntactic processing. For example, Bini (1993, cited in Sorace, 2005) found that Italian speakers acquiring L2 Spanish overuse overt pronouns in a manner similar to English acquirers of L2 Spanish, despite the fact that similar constraints on the use of null vs. overt pronouns are found in English and Spanish. In Experiment 3 I found no effect of syntactic properties of the learners' L1 on processing of L2 structures. However, this was not addressing a context in which interface constraints (e.g., lexical or discourse constraints) apply to syntactic processing, which is when L2 difficulties are most likely to arise. This issue requires further exploration.

A further empirical question is whether my findings will extend to L2 speakers at different proficiencies, given that I found no developmental effects on priming within the current studies. The participants I tested tended not to be at extremes of proficiency. For example, I avoided beginner L2 learners because of complications of designing appropriate linguistic materials. It would be interesting to explore whether developmental trends emerge when using less-proficient learners who have no previous experience with the L2 structures being tested (although there are methodological problems with studying early learners). Likewise, I did not specifically search out near-native L2 speakers, those at the final-state of acquisition. Would near-native L2 speakers therefore pattern with the advanced L2 groups' results, or would their results converge with those of the natives? Near-natives are still found to show some residual optionality with respect to interface

constraints on syntactic choices in the target language, and this suggests their behaviour might fall somewhere between the L1 and L2 speakers, but this remains to be tested.

9.2.2 Comparison with priming in children?

Throughout the thesis I have referred to how the processing of syntactic structures differs across L1 and L2 speakers. As described in Chapter 2, there has been a recent surge of interest in L2 comprehension processing. Results of studies on L2 adult comprehension have been directly compared to studies on L1 adults and on L1 children (e.g., Clahsen & Felser, 2006).

Interesting differences have been observed in processing across the three types of language users (child L1, adult L1 and adult L2). For example, in comprehending ambiguous sentences child L1 comprehenders appear less sensitive to lexical constraints on syntactic structure attachment than adult L1 speakers (e.g., Felser, Marinis & Clahsen, 2003; Traxler, 2002). This has been explained as constraints on children's memory load limiting their ability to integrate different types of information on-line. However, these children do apply syntactic strategies to constrain comprehension.

In contrast, similar studies on adult L2 comprehenders show an orthogonal pattern of results: non-native adult speakers, even at high proficiencies, are clearly sensitive to lexical semantic information in parsing but do not apply syntactic strategies to comprehension in the way natives do (see section 2.5.2.2).

These studies have looked at processing in comprehension, but an interesting extension of the current experiments would be to compare processing in *production* across L1 children, L1 adult and L2 adult speakers of the same language. In contrast to the finding in comprehension that L2 adults are sensitive to lexical semantic constraints on comprehension, Experiment 5 showed that adult L2 speakers of Spanish have not acquired native-like lexical constraints on structural preferences. Might L1 children show sensitivity to lexical constraints on syntactic production, not seen in their comprehension processing? Given that syntactic priming has been established in children, it would be interesting to explore lexical influences on priming in children to obtain a comparison with the comprehension data on processing.

9.2.3 Influence of pragmatic/discourse factors?

Recent research on L2 acquisition has shown that persistent residual optionality is seen particularly in features at the interface between syntax and discourse (e.g., Hertel, 2003; Hopp, 2005; Sorace, 2003, 2004, 2005), that is, when the different structural options have clear interpretive effects (Sorace, 2005). It would therefore be interesting to explore how well L2 speakers can integrate knowledge from discourse with syntactic knowledge, and how syntactic priming would affect this.

One case of optionality at the syntax-discourse interface is seen in word order in Spanish. Word order is determined not only by lexical preferences of unaccusative and unergative verbs (as discussed in this thesis), but also by the informational structure of the utterance. For example, new or focused constituents appear in sentence-final position; thus, VS word order with unergative verbs becomes pragmatically appropriate when the focus is on the subject of the phrase. L2 speakers are known to perform poorly when choosing the correct word order for a given pragmatic context (e.g., Hertel, 2003; Lozano, 2003, 2006). Although many psycholinguistic studies have shown an effect of context on choice of syntactic structure, there has been no previous exploration of how discourse factors influence syntactic priming.

Experimental investigation of this issue would require setting up a discourse, such that participants treat each item in the experiment as a continuing discourse, not as unrelated items. This could be done by repeating particular characters in the descriptions and telling participants to treat the experimental sentences as a continuous story. Interestingly, this would then make contrary predictions for conditions of lexical overlap. New information is placed at the end in Spanish. So, giving an SV prime, followed by a same-verb target, should produce VS word order because the verb is old information. It may be that discourse factors and syntactic factors can cause separate priming effects similar to the finding by Bock, Loebell and Morey (1992) that structural and semantic effects play separate and parallel roles in syntactic production.

Another line of future research would therefore be to explore how L1 and L2 speakers of a language integrate syntactic and discourse information on-line, and how this interacts with priming effects.

9.2.4 Locus of syntactic priming and lexical effects? Priming inappropriate things?

A final issue arising from the current studies is that syntactic priming as a phenomenon is not yet fully understood and warrants further investigation. In order to accurately interpret the findings of syntactic priming studies we must be able to fully understand the processes underlying it.

For example, in Chapter 7 we saw that lexical factors can influence the production of word order, both because repetition of a verb boosts a word order priming effect, and because the semantics of the verb involved influence what word order is chosen. However, syntactic priming studies to date have nearly always ignored the effect of individual lexical semantics on the strength of priming observed. In contrast, it is a well-known fact from comprehension studies that the semantics and argument structure of lexical items influence on-line parsing (e.g., Frazier & Clifton, 1996; Kamide, Altmann & Haywood, 2003; see Gibson & Pearlmutter, 1998 for a review). If the lexical boost is assumed to reflect priming of a link between syntactic representations and individual lexical items, a way to explore this link further is to ask how strong the association is and how this influences the lexical boost. Experiment 5 showed the lexical boost to word order priming was weaker when the verb involved dispreferred that word order option. Would the same be found for lexical preferences on phrasal structures, such as the PO-DO alternation?

Another question raised by Experiments 5 and 6 is the exact locus of lexical effects on priming magnitude. The effects of frequency (and, therefore, presumably preferences) on priming have been discussed previously, suggesting that the strength of syntactic priming is determined by preferences of the *prime* structure (Ferreira, 2003b). This is proposed under the hypothesis that syntactic priming results from long-term strengthening of the processes involved in producing the primed syntactic structure. The less frequent the structure, the higher the error cost in processing the structure and therefore the higher the learning and priming effect. However, the results of Experiment 6 suggest that priming magnitude or susceptibility is determined by the structural preferences of the verb in the *target*. Indeed, when all target items used unaccusative verbs then inappropriate unergative primes had the same impact on target word order as acceptable unaccusative primes. This suggests that susceptibility to priming is

independent of the lexical head of the prime phrase, and that it is the lexical preferences of the target which determine the magnitude of priming.

9.3 Final summary

The aim of this thesis was to apply experimental psycholinguistic techniques to compare sentence production in L1 and L2 speakers. The results support models which claim broad similarities across native and adult non-native syntactic representations and processing mechanisms. However, there was also evidence of L2 optionality: L2 speakers appeared less sensitive to constraints on the use of particular structures in the target language, and this caused non-nativelike behaviour.

These studies open up promising areas for future research on L2 acquisition, particularly with respect to encouraging dialogue between linguistics and psycholinguistics.

10 References

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